APTOS
ASIA PACIFIC TELE-OPHTHALMOLOGY SOCIETY

2019
CHENNAI, INDIA
Sept 21-22
APTOS

The 4th Asia Pacific Tele-Ophthalmology Society (APTOS) Symposium

Chennai, India
September 21 – 22, 2019

■ PROGRAM BOOK

FULLY AUTOMATED OCT & FUNDUS CAMERA,

NOW WITH OCTA

new **Maestro2**

Hood Report for Glaucoma

OCT Angiography*

*Optional

Follow-up Scan

Robotic OCT

High Resolution OCT Image

True Color Fundus Image

Normative Database

Speed of Use

Space Saving

Maestro2 = Product name: 3D Optical Coherence Tomography 3D OCT-1 (Type: Maestro2)

MEHRA EYETECH PRIVATE LIMITED
A TOPCON GROUP COMPANY

MEHRA EYETECH PRIVATE LIMITED
801 B Wing, Lotus Corporate Park,
Graham Firth Steel Compound Goregaon (East)
Mumbai 400063 Maharashtra, INDIA
Phone:+91-22-61285455 www.mehraeyetech.in

TOPCON
YOUR VISION. OUR FOCUS.

CONTENTS

FOREWORD

From Congress President

Dear Friends & Colleagues,

On behalf of the Aravind Eye Care System, we would like to offer you a warm welcome to the 4th Asia Pacific Tele-Ophthalmology Society (APTOS) Symposium in Chennai, India.

Tele-medicine has made "reaching the unreached" possible. With increasing imaging capabilities, ophthalmology is best placed to make the most of it. Today, the advent of machine learning and Artificial Intelligence (AI) has the potential to further improve diagnosis and predict outcomes. This will eventually revolutionize care for our patients as we are enabled to provide it in a more and more personalized manner. Big data and the use of advanced analytics are bringing a major transformation to the Healthcare sector worldwide. Analytics-assisted care would become an integral part of ophthalmology practices in the future.

At the 4th APTOS Symposium, experts are sharing how emerging, innovative digital technologies are used in different parts of the world to enhance ophthalmic care. The theme of this year's meeting is the evolution of AI in the ophthalmologic revolution. We will see how far AI has evolved from the inaugural APTOS Symposium in 2016 and look at what it is capable of doing in ophthalmology and the revolution it has brought to the ophthalmic community.

A major highlight of APTOS 2019 is our inaugural Big Data Competition. In 2 months' time, over 3,500 participants had formed almost 3,000 teams and made 63,163 entries. Our heartiest congratulations to the winning teams, who beat their fellow competitors by 0.001. Do check out the solutions offered by the winning teams online and we are pleased to have them participate and present in one of our sessions. By looking at the potential of AI and big data analytics, we hope to improve diagnostics for better patient care delivery. We will also further our roundtable discussions on the practicality and the regulatory implications of emerging digital technologies as well as ethical considerations. Hopefully, we will soon reach a consensus on the use of AI as a diagnostic tool.

Chennai is often referred to as the "Soul of South India." The city has a lot to offer – from museums to temples; and from authentic South Indian cuisines to contemporary restaurants. It is my sincere hope that you can make the most out of your stay here. See you around!

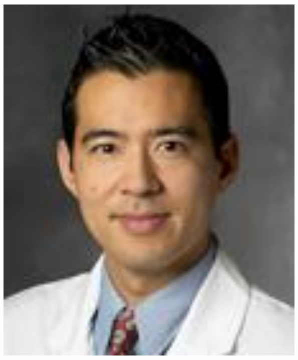
FOREWORD AND WELCOME MESSAGES

Yours sincerely,

Kim RAMASAMY, MD
Congress President, APTOS 2019

FOREWORD

From Scientific Program Committee Chair



Dear Friends and Colleagues,

We are excited you have joined the Asia Pacific Tele-Ophthalmology Society (APTOS) 4th Annual Symposium in Chennai. This year's theme focuses on training future AI specialists to improve ophthalmology care worldwide. We held our first ever 2019 Kaggle Blindness Detection Competition, including thousands of participants across the globe. We are eager to engage the community of physicians, data scientists, and AI enthusiasts to help incorporate rapidly evolving computer algorithms into clinical care.

Now more than ever, it is critical for our medical profession to understand AI, especially when it comes to privacy, transparency, and explainability. We are fortunate to have distinguished international faculty from both the eye community and industry to share their work and experience, and we hope to have lively discussions on how to translate AI into clinical practice. This is truly a unique meeting of growing importance and relevant not just to ophthalmology, but all fields of medicine.

Welcome to the cosmopolitan city of Chennai, and I wish you a wonderful stay.

Yours sincerely,

Robert CHANG, MD
Scientific Program Chair, APTOS 2019
Vice-President, Asia Pacific Tele-Ophthalmology Society

WELCOME MESSAGE

From President, Asia Pacific Tele-Ophthalmology Society

Dear Friends & Colleagues,

Welcome to the 4th Asia Pacific Tele-Ophthalmology Society (APTOS) Symposium in Chennai, India! This year, we have launched our inaugural Big Data Competition, which is very well-received. As the first of its kind in ophthalmology, the Competition drew together 3,588 competitors from around the world. They formed 2,987 teams and submitted a total of 63,163 entries. The highest score is 0.936, closely followed by 0.935 and 0.934.

As we can see from the Big Data Competition, artificial intelligence (AI) has a diabetic retinopathy (DR) detection accuracy of over 93%, compared to the 80% benchmark that we use to qualify a human image grader. As we train and refine our AI algorithms, it is our dream that the use of AI will assist in early DR detection, enabling us to provide timely treatment for our patients. We hope to prove to the ophthalmic community that AI is more of a friend than a foe in eliminating preventable blindness. Think of the days when we feared computers would take over all the jobs. History proves that computers have enabled us to lead a much easier life, freeing our mind to focus on more important tasks. AI, as a different form of computers, will certainly revolutionize the way we practice ophthalmology. The day will come when we can finally spend more time with our patients to give them both physical and psychological support.

As APTOS continues to improve and develop, your participation means a lot to us. In this year’s annual meeting, we strive to provide a better platform for fruitful discussions. With our roundtables, we hope to reach a consensus on AI-based telemedicine with recommendations on how we can translate our algorithms into clinical practice. We will continue our discussions online and conduct our first AI consensus meeting in our future annual meetings. We are grateful for your participation and we wish you a wonderful time in Chennai.

Yours sincerely,

Mingguang HE, MD, PhD
President, Asia Pacific Tele-Ophthalmology Society

FOREWORD AND WELCOME MESSAGES

WELCOME MESSAGE

From Secretary-General, Asia-Pacific Tele-Ophthalmology Society

Dear Friends & Colleagues,

I would like to welcome you all to the 4th Asia Pacific Tele-Ophthalmology Society Symposium.

Since the inauguration of APTOS in 2016, digital technologies and their applications to public health have been expanding quickly. “Big data”, machine learning, and artificial intelligence (AI) promise great benefit to the practice of medicine and to the health of populations. At the same time, escalating use of Big data and AI, i.e., the collection, storage, analysis, use and sharing of large data sets, poses many ethical challenges regarding governance, quality, safety, standards, privacy and data ownership. Do we know enough about the algorithms that are used? What safeguards need to be in place as AI advances in ophthalmology?

The theme of this year’s meeting will be the evolution, validation, and sustainability of AI. We will look at tele-ophthalmology initiatives from around the world to better understand what works well and where key challenges remain. The second day will address regulation and policy needs for AI in ophthalmology.

A highlight though will clearly be the first APTOS Hackathon and the Big Data DR Challenge. I wish all participants and teams good luck.
I hope you will find the 4th APTOS Symposium a great place for learning, sharing and networking.

Yours sincerely,

Andreas MÜLLER, MPH, PhD
Secretary-General, Asia-Pacific Tele-Ophthalmology Society

HOSTS

Asia-Pacific Tele-Ophthalmology Society

(APTOS)

Founded by a group of outstanding tele-ophthalmology specialists in the Asia-Pacific region in May 2016, the Asia Pacific Tele-Ophthalmology Society (APTOS) aims to bring together clinicians, researchers, technicians, institutes and organizations to form an alliance that promotes communication, exchange and collaboration in tele-ophthalmology. It provides a platform on which eye care or tele-medical professionals can share knowledge and collaborate to deliver efficient, accessible and quality universal eye care throughout the region.

Contact us:
APTOS Secretariat
c/o State Key Laboratory (Ophthalmology)
Zhongshan Ophthalmic Center, Sun Yat-Sen University
1/F, No. 7 Jinsui Road
Zhujiang New Town, Tianhe District
Guangzhou, Guangdong, P.R. China
Webiste: www.asiateleophth.org
Email: secretariat@asiateleophth.org

HOSTS

Aravind Eye Care System

(AECS)

In 1976, Dr. Govindappa Venkataswamy (popularly referred as Dr. V) opened an 11-bed eye clinic in a rented house in Madurai, India, with the mission to eliminate needless blindness.
He pioneered a new health care model that reaches out to the communities and combines high quality and high volume along with low cost.

Aravind operates a growing network of 13 eye hospitals, 6 outpatient eye examination centres and 76 primary eye care facilities in South India. Over 5 lakh eye surgeries or procedures are performed a year at Aravind, making it the largest eye care provider in the world. Since its inception, Aravind has handled more than 6 crore (61 Million) outpatient visits and performed more than 73 lakh (7.3 million) surgeries - with over 50% provided free or subsidized to the poor. The costs and finances are managed in such a way that revenue from paying patients makes the organization financially self-sustainable. An assembly-line approach coupled with stringent management practices help achieve high operational efficiency.

Tele-medicine network at Aravind was launched in 2002 with support from ORBIS and Acumen Fund. Since then, tele-medicine link has been established between various Aravind centres. It is now being used regularly and extensively for patient care as well as educational purposes.

On the patient care front, Aravind uses tele-ophthalmology in its primary eye examination centres (referred to as vision centres) and in the screening of diabetic retinopathy and Retinopathy of Prematurity. Vision centres are small eye care facilities located in the rural or suburban areas that cater to a population of 50,000 to one lakh. There is no ophthalmologist here and the Centre is run and managed by two ophthalmic technicians. Patients are given an opportunity to interact with the doctor stationed in the base hospital via videocnferencing and avail treatment. More than 90% of the cases are addressed locally thus eliminating the need for the patient and an accompanying person to travel to cities for eye care. This also helps save money and time for the patients. Currently, Aravind has 76 such centres which handle over 600,000 patient visits a year. Aravind's vision centre model has proved to be successful in achieving universal coverage in eye care and is being widely replicated in various states of India and Bangladesh.

Aravind works with various diabetes care centres to screen diabetic retinopathy cases through teleconsultation with the help of Aravind Diabetic Retinopathy Evaluation Software (ADRES). Fundus image of the patient with diabetes is captured at the diabetes clinic using a fundus camera which is sent immediately to the Aravind Eye Hospital, where a retina specialist or a trained grader reviews the images and sends a report back regarding the presence or absence of DR within an hour.

Currently, screening for Retinopathy of Prematurity (RoP) and its management is happening sporadically in India. It is non-existent in rural areas and in the urban areas, where it is available, the accessibility is not uniform. Often children are brought to the hospital at stages 4 and 5, at which point, it is beyond the scope of restoring vision. Aravind deploys tele-ophthalmology to effectively address this issue. Centres at Coimbatore, Tirunelveli and Madurai have initiated a project to screen babies for the disease in the underserved and rural areas by a trained technician. Using a retinal camera, babies with this disease will be identified real time by transmitting the retinal images to a remote RoP expert. Necessary intervention is also provided.

Aravind also uses tele-ophthalmology platform for several educational interactions including grand rounds and journal clubs. Over 500 videoconferencing sessions are being conducted in this regard every year.

Contact us:
1, Anna Nagar, Madurai – 625020 Tamil Nadu, India
Website: www.aravind.org
Email: patientcare@aravind.org

COUNCILS AND COMMITTEES

■ ORGANIZING COMMITTEE

Congress President
Dr. Kim RAMASAMY

Organizing Secretary
Dr. Karthik SRINIVASAN

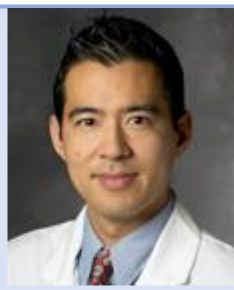
Scientific Committee – Chair
Dr. Robert CHANG

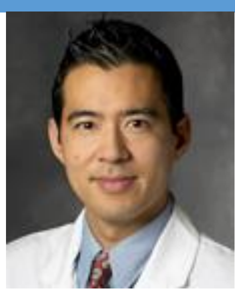
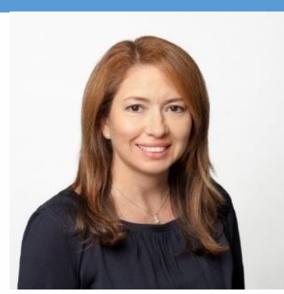
Scientific Committee – Advisors
Dr. Senthil TAMILARASAN
Mr. Dushyanthsinh JADEJA

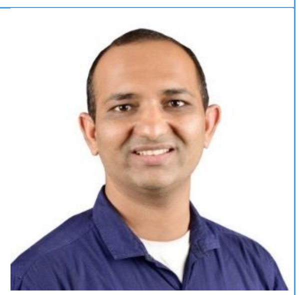
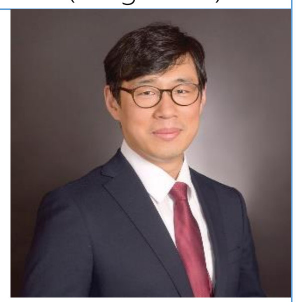
Members - Organizing Team
Mr. Sanil JOSEPH
Mr. KARTHIKEYAN
Mr. SIDDIQUE
Ms. Florence CHUNG
Ms. SIVAKARTHIKA
Ms. UMADEVI

COUNCILS AND COMMITTEES

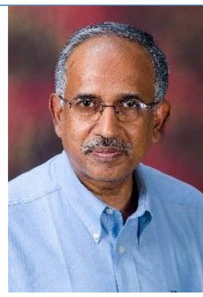
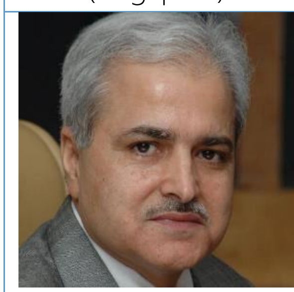
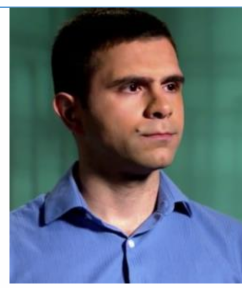
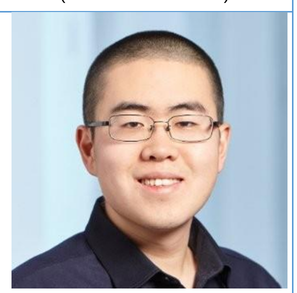
SCIENTIFIC PROGRAM COMMITTEE & FACULTY

Chair:	Co-Chair:
	
Robert CHANG (US)	Kim RAMASAMY (India)

Keynote Speakers			
			
Robert CHANG (United States)	Rebecca CANINO (United States)	Maggie DEMKIN (United States)	Krishnan GANAPATHY (India)
			
Mingguang HE (Australia)	Sundaram NATARAJAN (India)	Lily PENG (United States)	

Invited Speakers			
			
Ganesh BABU B. (India)	Ganesh BABU T. C. (India)	Pinal BAVISHI (India)	K. CHANDRASEKHAR (India)
			
K. CHELLARANI (Chile)	Gabriela CZANNER (United Kingdom)	Naama HAMMEL (United States)	Dushyantsinh JADEJA (India)
			
Sheila JOHN (India)	Yogesan KANAGASINGAM (Australia)	Richel LIU (China)	Golam MOSTAFA (Bangladesh)
			
R. RAJALAKSHMI (India)	Rajiv RAMAN (India)	Kim RAMASAMY (India)	Tyler RIM (Singapore)

COUNCILS AND COMMITTEES

Invited Speakers			
			
Paisan RUAMVIBOONSUK (Thailand)	Parag SHAH (India)	Senthil TAMILARASAN (India)	Gavin TAN (Singapore)
			
Jack TAN (Singapore)	R. D. THULASIRAJ (India)	Anand VINEKAR (India)	Sunny VIRMANI (United States)
			
Vimal WAKHLU (India)	Kasumi WIDNER (United States)	Reza ZADEH (United States)	Ce ZHANG (Switzerland)
			
Ingrid ZIMMER-GALLER (United States)			

COUNCILS AND COMMITTEES

THE APTOS COUNCIL

Office Bearers

President
Minguang HE
(Australia)

Secretary-General
Andreas Müller
(Australia)

Vice President
Robert CHANG
(US)

Vice-President
R. D. THULASIRAJ
(India)

Assistant Secretary-General
Ryo KAWASAKI
(Japan)

Treasurer
Carol CHEUNG
(Hong Kong)

Council Members

Joanthan
CROWSTON
(Australia)

Wei HE
(China)

Dennis LAM
(Hong Kong)

Gavin TAN
(Singapore)

Angus TURNER
(Australia)

Ningli WANG
(China)

Tien-Yin
WONG
(Singapore)

Lin Chung
WOUNG
(Taiwan)

Sangchul
YOON
(South Korea)

PROGRAM OVERVIEW

		21/9/2019 (Sat)		22/9/2019 (Sun)
8:00-8:30		Registration		Registration
8:30-9:00				Free Paper Session 1
9:00-9:30		Symposium 1		
9:30-10:00				
10:00-10:30		**Opening Ceremony**		Tea Break & Exhibition
10:30-11:00				Symposium 5
11:00-11:30		Tea Break & Exhibition		
11:30-12:00		Symposium 2		
12:00-12:30				Symposium 6
12:30-13:00				
13:00-13:30		Lunch & Exhibition		
13:30-14:00	**Registration**		**Registration**	Lunch & Exhibition
14:00-14:30		Symposium 3 & Roundtable Discussions		
14:30-15:00				Symposium 7: Big Data Competition Winnng Teams' Presentations
15:00-15:30				
15:30-16:00		Tea Break & Exhibition		
16:00-16:30		Symposium 4		Free Paper Session 2
16:30-17:00				
17:00-17:30				
17:30-18:00				**Closing Remarks**
18:00-18:30		**Concert**		
18:30-19:00				
19:00-19:30		First-Time Attendee Get-Together		
19:30-20:00				

SCIENTIFIC SESSIONS

DAY 1 – SEPTEMBER 21, 2019 (Saturday)

Time	Venue	Type	Theme
09:00 – 10:00	Rajendra Hall 7 & 8	Invited	Notes from the Field in Using Tele-Ophthalmology
10:00 – 11:00	Rajendra Hall 7 & 8	Inauguration	Opening Ceremony
11:30 – 13:00	Rajendra Hall 7 & 8	Invited	Global Tele-Ophthalmology Initiatives
14:00 – 15:30	Rajendra Hal 7 & 8	Roundtable	AI – Solving Today's Problems & Opening New Frontiers
16:00 – 17:30	Rajendra Hall 7 & 8	Invited	Techno-Clinical Alliance in Tele-Ophthalmology

DAY 2 – SEPTEMBER 22, 2019 (Sunday)

Time	Venue	Type	Theme
08:30 – 10:00	Rajendra Hall 7 & 8	Free Paper	Artificial Intelligence & Deep Learning
10:30 – 12:00	Rajendra Hall 7 & 8	Invited	AI: Applied Stage
12:00 – 13:30	Rajendra Hall 7 & 8	Invited	Regulations & Policies in Using AI in Tele-Ophthalmology
14:30 – 16:00	Rajendra Hall 7 & 8	Invited	Tele-Ophthalmology Challenge
16:30 – 18:00	Rajendra Hall 7 & 8	Free Paper	Machine Learning & Tele-Ophthalmology

CONGRESS INFORMATION

Name of Event
The 4th Asia Pacific Tele-Ophthalmology Society Symposium (APTOS 2019)

Venue
ITC Grand Chola, Chennai, India

Registration Counter & Delegate Bag Collection
Location: Sembian Porch & Wooster, ITC Grand Chola

On-Site Payment
On-site payment with cash and credit card can be made at the registration and payment counter.

Delegate Bag Pick Up – Registration Counter
Delegates can collect their delegate bags at the registration counter.

Coffee Breaks & Lunch
Coffee and refreshments are served between sessions in the morning and in the afternoon. Lunch is inclusive in the registration and served in Rajendra Hall 6, Level 2, ITC Grand Chola.

Policies
No Smoking Policy
Smoking is strictly prohibited in all session rooms, meeting and exhibition areas. Your cooperation is appreciated.

Photographing in Exhibition Hall
Attendees wishing to photograph or videotape an exhibit must obtain permission from the relevant company beforehand.

Photographing or Videotaping for Scientific Sessions
Photographing and/or videotaping during any of the Scientific Sessions are strictly prohibited. (Permission must be obtained in advance by media representatives.)

Re-Issue of Delegate Badge
Reissuing of delegate badges will be available at the Registration. Badges are non-transferable. An administration fee of USD20 may be incurred for re-issuing a delegate badge.

Speaker Ready Room/Preview Room – Rear End of Rajendra Hall 7 & 8
Opening Hours:

Date	Time
September 21, 2019	0800-1730
September 22, 2019	0730-1730

E-Poster & Video Platform – Pre-Function Area
Delegates can visit the E-poster and Video Platform located at the Pre-Function Area.

GENERAL INFORMATION

Congress Venue

The 4th Asia Pacific Tele-Ophthalmology Society Symposium will be held in ITC Grand Chola, Chennai, India.

ITC Grand Chola is dubbed the largest stand-alone hotel in India and has the largest convention center built on 100,000 sq ft with a 30,000-sq ft pillar-less ballroom, Rajendra (left). Rajendra has its own pre-function area of over 17,000 sq ft and can be divided into eight separate halls, each with sound proofing capabilities. There are also four Kaveri meeting rooms, which are unmatched manifestations of corporate class. At a total area of 650 sq ft each, these posh spaces are fitted with a host of accoutrements.

Venue Information

Address: No. 63, Mount Road, Guindy, Chennai, Tamil Nadu 600032
Phone: (+91) 44 2220 0000

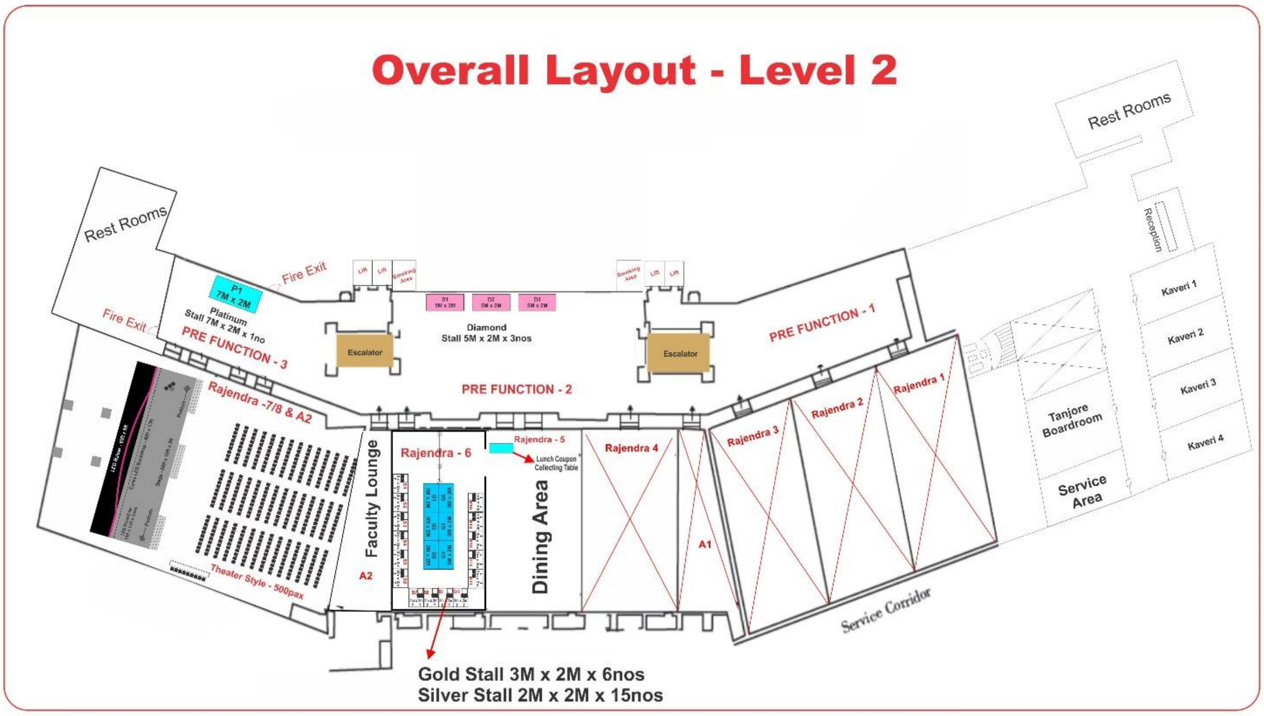
SOCIAL PROGRAM

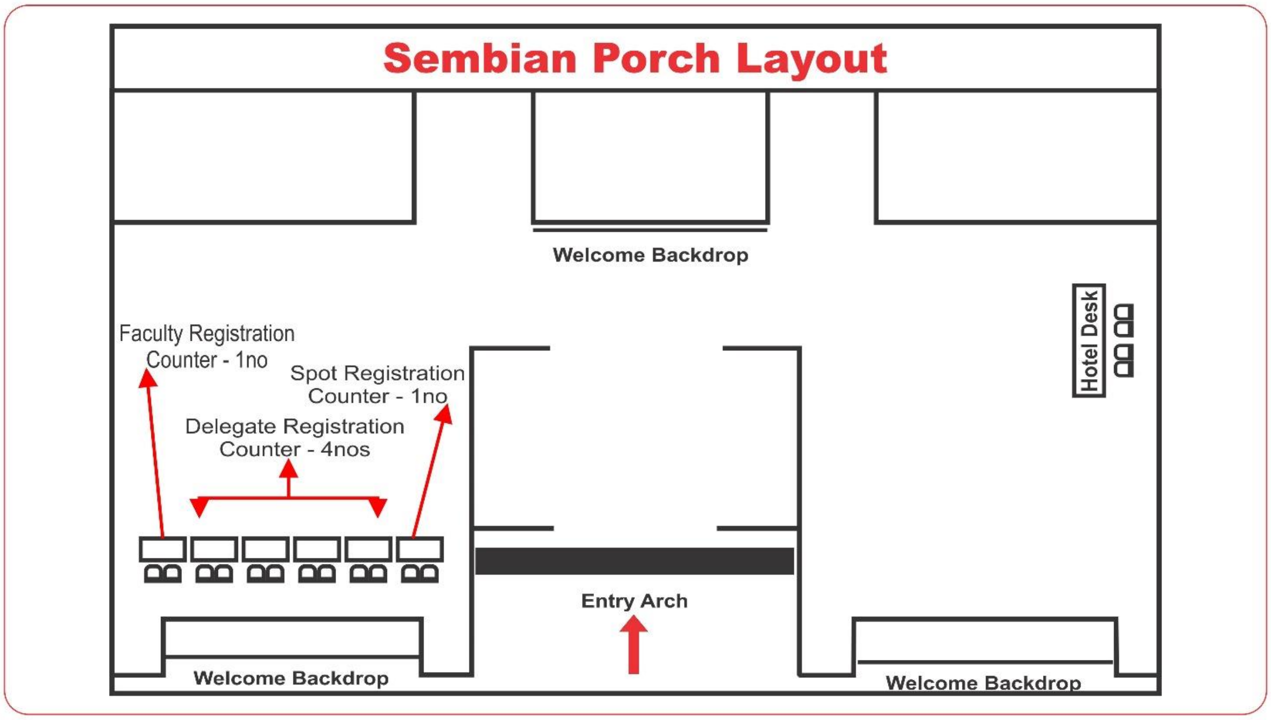
First-Time Attendee Happy Hour & President's Reception

Date: September 21, 2019
Time: 6:00 – 8:00 pm
Venue: Rajendra Hall 6, Level 2, ITC Grand Chola, Chennai
Format: Live Concert & Cocktail Reception

The event is free-of-charge to all delegates while first-time attendees will enjoy priority in securing a spot.

FLOOR PLAN


Overall Layout - Level 2
Rest Rooms
Fire Exit
P1 7M x 2M
Platinum Stall 7M x 2M x 1no
PRE FUNCTION - 3
Escalator
Diamond Stall 5M x 2M x 3nos
PRE FUNCTION - 2
PRE FUNCTION - 1
Rajendra -7/8 & A2
Theater Style - 500pax
Faculty Lounge
A2
Rajendra - 6
Rajendra - 5
Lunch Coupon Collecting Table
Dining Area
Rajendra 4
A1
Rajendra 3
Rajendra 2
Rajendra 1
Service Corridor
Tanjore Boardroom
Service Area
Reception
Kaveri 1
Kaveri 2
Kaveri 3
Kaveri 4
Gold Stall 3M x 2M x 6nos
Silver Stall 2M x 2M x 15nos


Sembian Porch Layout
Welcome Backdrop
Faculty Registration Counter - 1no
Spot Registration Counter - 1no
Delegate Registration Counter - 4nos
Hotel Desk
Entry Arch
Welcome Backdrop
Welcome Backdrop

CORPORATE PARTNERS

Big Data Competition Sole Sponsor:

Kaggle is an online community of data scientists and machine learners, owned by Google LLC. Kaggle allows users to find and publish data sets, explore and build models in a web-based data-science environment, work with other data scientists and machine learning engineers, and enter competitions to solve data science challenges. Kaggle got its start by offering machine learning competitions and now also offers a public data platform, a cloud-based workbench for data science, and short form AI education.

Website: www.kaggle.com

Platinum Sponsors:

Verily

Verily lives at the intersection of technology, data science and healthcare. Our mission is to make the world's health data useful so that people enjoy healthier lives.

Verily is developing tools to collect and organize health data, then creating interventions and platforms that put insights derived from that health data to use for more holistic care management. We have three guiding product design principles: start with the user, simplify care, and lead on security and privacy.

Website: https://verily.com/

Google

Google LLC is an American multinational technology company that specializes in Internet-related services and products, which include online advertising technologies, search engine, cloud computing, software, and hardware.

Founded in 1998 by Sergey Brin and Larry Page, Google is a subsidiary of the holding company Alphabet Inc. More than 70 percent of worldwide online search requests are handled by Google, placing it at the heart of most Internet users' experience. Its headquarters are in Mountain View, California.

Google began as an online search firm, but it now offers more than 50 Internet services and products, from e-mail and online document creation to software for mobile phones and tablet computers. In addition, its 2012 acquisition of Motorola Mobility put it in the position to sell hardware in the form of mobile phones. Google's broad product portfolio and size make it one of the top four influential companies in the high-tech marketplace, along with Apple, IBM, and Microsoft. Despite this myriad of products, its original search tool remains the core of its success. In 2016 Alphabet earned nearly all of its revenue from Google advertising based on users' search requests.

Website: www.google.com

Gold Sponsors:

MEHRA EYETECH
PRIVATE LIMITED
A TOPCON GROUP COMPANY

Mehra Eyetech Private Limited (MEPL) began its journey in 2003 with the distribution of Topcon eye care products. MEPL is now a subsidiary of Topcon Corporation Japan and we supply state-of -the-art products of TOPCON, LIGHTMED, PLANTECH, OPTILASA and VOLK to the customers in India and provide the after sales services. MEPL is also providing comprehensive data management & screening solutions developed by Topcon Healthcare Solutions now.

Website: www.mehraeyetech.in

TOPCON
Healthcare Solutions

Topcon Healthcare Solutions is the software and Teleophthalmology arm of Topcon. It was created to develop the best diagnostic software platform in Healthcare. Our in-depth knowledge of eye care and cutting-edge technology places us in a unique position to offer you the full range of our comprehensive data management & screening solutions.

Website: www.topconhealth.com

Silver Sponsor:

ZEISS is an internationally leading technology enterprise operating in the fields of optics and optoelectronics. With a portfolio aligned with future growth areas like digitalization, healthcare and Smart Production and a strong brand, ZEISS is shaping the future far beyond the optics and optoelectronics industries. The company's significant, sustainable investments in research and development lay the foundation for the success and continued expansion of ZEISS' technology and market leadership.

Website: www.zeiss.com

Exhibitors:

Alcon is the global leader in eye care, dedicated to helping people see brilliantly. With our 70 – plus – year heritage, we are the largest eye care device company in the world – with complementary business in surgical and Vision Care. Being a truly global company, we work in over 70 countries and serve patients in more than 140 countries. We have a long history of industry firsts, and each year we commit a substantial amount in research and development to meet customer needs and patient demands.

Website: www.alcon.com

Aurolab, based in southern part of India, is an integral part of the Aravind Eye Care System. It manufactures a wide range of high-quality ophthalmic consumables such as intraocular lenses, surgical sutures, pharmaceutical products, surgical blades and equipment.

Though its primary focus is on ophthalmic segment, Aurolab is diversifying into related health care areas where its existing capabilities can be leveraged, such as cardiovasular sutures, microsurgical hand sutures, antiseptics and disinfectant solutions, spectacle cleaner etc.

Website: www.aurolab.com

We are a social enterprise which has developed affordable and portable eye screening devices which use a smartphone to capture and store ophthalmic data for diagnostic purpose.

Our aim is to reduce preventive blindness cases by making eye screening more accessible and affordable.

At present we have developed two eye examination devices:
1. C3 Vision- Portable Slit Lamp
2. C3 Funduscam- Portable Fundus Cam

Website: http://c3prototypes.com

CONGRESS INFORMATION

Forus Health is a medical technology company with an audacious goal — to eradicate preventable blindness, which is a global healthcare challenge today.

We believe that innovation in technology and creative business models can help develop sustainable access to vision care. Creating social impact is in our DNA and every product we design is a direct consequence of solving a problem. This is the very philosophy with which our founding team — curious minds passionate about creative problem-solving — set out to create a healthcare ecosystem in 2010 in Bangalore, India.

Website: www.forushealth.com

We developed AI that can predict various systemic risk factors from retinal photos. We are offering AI that can predict various systemic risk factors from the retina. Our AI enables us to predict Cardiovascular disease, Sarcopenia and Kidney function, through simple fundus photographs. Specifically, predicting coronary artery calcification from retinal photographs is opening new horizons for healthcare.

Website: www.medi-whale.com

Novartis is a global healthcare company based in Switzerland that provides solutions to address the evolving needs of patients worldwide. Our purpose is to reimagine medicine to improve and extend people's lives. We use innovative science and technology to address some of society's most challenging healthcare issues. We discover and develop breakthrough treatments and find new ways to deliver them to as many people as possible. We also aim to reward those who invest their money, time and ideas in our company.

Website: www.novartis.com

Remedio is focused on disruptive solutions in screening and diagnostic imaging in ophthalmology. We are an innovative ISO13485 certified medical device company that seeks to create Healthcare Access using principles of Design Thinking.

Website: www.remedio.com

Established in 1983, Sun Pharma has the vision to reach people and touch lives globally as a leading provided of valued medicine. We strive to implement new ideas and technologies to meet unmet needs.

Website: www.sunpharma.com

KEYNOTE LECTURES

Title: Challenges of Setting up a Telemedicine Program
Date: September 21, 2019
Time: 09:30 – 09:45

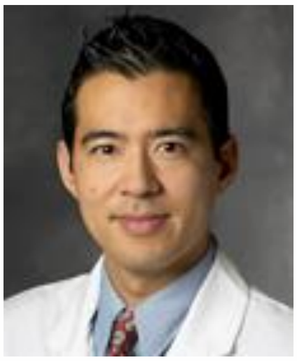
Dr. Rebecca CANINO

Administrative Director of Telemedicine, Johns Hopkins Health System

Dr Rebecca Canino has been with Johns Hopkins Medicine as an Operations Manager since 2007. Her background includes a long history with international nonprofit startups, and when she returned stateside, the innovation, collaboration, creativity, and compassion for patients that she found at Hopkins fit her personal mission like a glove. She is passionate about reaching as many people as possible with the clinical excellence and game-changing research of our physicians. She is thrilled to join the Telemedicine team because she believes that Telemedicine is the optimal platform for our shared mission: improving the health of our community and the world.

KEYNOTE LECTURES

Title: Natural Language Processing Advancements in AI
Date: September 21, 2019
Time: 14:00 – 14:15



Dr. Robert CHANG

Assistant Professor of Ophthalmology, Stanford University Medical Center

Dr. Chang runs a busy glaucoma and cataract surgical practice with special expertise in minimally invasive glaucoma surgery (MIGS such as iStent, ECP, trabectome, KDB, Omni, Cyclo G6 Micropulse, Cypass, Xen) and complex cataract removal using the latest technologies including intraop aberrometry (ORA) and toric lenses as well as multifocals/ EDOF including Restor and Symfony. He is an expert on optical coherence tomography (OCT) having helped the normative data development of Zeiss Stratus and Cirrus. Besides providing state of the art clinical care, delving into cutting edge research, and delivering world class education, he is involved in the development of novel mobile health devices and digital health startups as well as scientific advisor to multiple pharmaceutical and medical device companies. Current research interests include: high myopia and glaucoma, sensors during surgery, improving glaucoma therapy compliance, validating eye care delivery systems leveraging mobile devices, developing computer vision machine learning algorithms, and aggregating big data with differential privacy features.

Dr. Chang co-invented the EyeGo Smartphone imaging adapter, which was commercialized as the Paxos Scope. He is co-founder of a new seed stage consumer health startup, AVA. Currently, he is Vice President of the Asia Pacific Tele-Ophthalmology Society and medical director of employer-based optometry services. One of his original contributions is the creation of the digital health design sprint, a week-long, end-to-end project-based learning experience to help innovators be more aware of the challenges in starting a healthcare company.

KEYNOTE LECTURES

Title: How We Did It? Kaggle
Date: September 22, 2019
Time: 14:30 – 14:45

Ms. Maggie DEMKIN

Customer Success & Business Development, Kaggle Team@ Google

As a Google company, Terra Bella is pioneering the search for patterns of change in the physical world—helping address global economic, environmental, and humanitarian challenges by combining our high-performance imaging satellites with Google's computing infrastructure and data-crunching power.

As head of customer success at Terra Bella, Ms. Demkin participates in forming a new product that brings to market satellite imagery from space. Her work with the team and their customers—developing and leading customer experience in partnership with key enterprise relationships—began at Skybox Imaging, which was acquired and rebranded as Terra Bella in 2014.

Prior to Google/Terra Bella, she launched new services and products for a Top 100-ranked FinTech company (recognized by American Banker and Financial Insights) and served as a program manager helping launch a local trading business in Hong Kong for the world's #1 online stock broker and investment management firm.

In each role, she has created department and division infrastructures, systems, and customer experiences to help scale global operations and services. The most enjoyable part of her work has been building and managing technical/service organizations where collaborative fun, good ideas, and innovation are encouraged—all while helping global enterprise customers grow their bottom line.

KEYNOTE LECTURES

Title: AI in Neurosciences
Date: September 22, 2019
Time: 10:30 – 10:45

Even after making allowance for an unprecedented hype, it is an undeniable fact that, in the coming decade, deployment of Artificial Intelligence (AI) will cause a paradigm shift in the delivery of healthcare. This presentation will review the practical utility of AI in neurosciences from a clinician's perspective. Devoid of the complex, technical computation jargon, the authors will critically review the exponential development in this area from a clinical standpoint. The reader will be exposed to the fundamentals of AI in healthcare and its applications in different areas of neurosciences. Powerful AI techniques can unlock clinically relevant information, hidden in massive amounts of data. Translating technical computational success to meaningful clinical impact is however a challenge. AI requires thorough and systematic evaluation, prior to integration in clinical care. Like other disruptive technologies in the past, the potential for impact should not be underestimated. A scenario in which medical information, gathered at the point of care, is analysed using sophisticated machine algorithms to provide real-time actionable analytics seems to be within touching distance.

Dr. Krishnan GANAPATHY

Emeritus Professor, Dr MGR. Tamilnadu Medical University

K. GANAPATHY M.Ch. (Neurosurgery), FACS, FICS, FAMS Ph.D. is a Past President of the Telemedicine Society of India. former Secretary and Past President of the Neurological Society of India, former Secretary of the Asian Australasian Society of Neurological Surgery, Past President of the Indian Society of Stereotactic & Functional Neurosurgery. Formerly Adjunct Professor, at the IIT Madras, & Anna University he is currently Emeritus Professor at the Dr MGR. Tamilnadu Medical University, Chennai. Dr. Ganapathy was formerly Honorary Consultant and Advisor in Neurosurgery Armed Forces Medical Services. In 1990, he became the first in South Asia to get a Ph.D. in neuro-imaging. A former examiner & Inspector for the National Board of Examinations Ministry of Health, Govt. of India he was also an overseas examiner to the Universiti Sains Malaysia and the Royal College of Surgeons Edinburgh. He is Member of the Editorial Board of 4 International and 3 National Journals in Neurosciences and was the first neurosurgeon from South Asia to be formally trained in Stereotactic radiosurgery in 1995 and later in robotic radiosurgery in 2008. He is a reviewer for ATA's official journal and other telemedicine journals. A pioneer in introducing Telemedicine in India Dr. Ganapathy has been working relentlessly from 1999, for the growth and development of Telemedicine in India. He was a Member of the National Task Force on Telemedicine. He started the first formal Certificate course on Telehealth Technology, in conjunction with the Anna University. He was a mentor for MBA scholars from Harvard Business School and for the Ross Business School University of Michigan, the Yale University and from several globally renowned Indian universities During the last 42 years he has presented more than 430 papers in national conferences and 170 in International meetings. He has published about 210 scientific papers & 16 chapters in books, besides about 70 articles in "The Hindu" a widely read English newspaper. He is President of the Apollo Telemedicine Networking Foundation, the largest and oldest multi-specialty Telemedicine network in South Asia and Director, Apollo Telehealth Services. In Nov 2007, he organized a well-attended international conference on telemedicine at Chennai. He has been on the faculty for several World Federation of Neurosurgical Societies Educational Programmes. A former member of the Programme Advisory Committee (Health Sciences) Dept. of Science & Technology Govt. of India he is currently a member of BIRAC (Biotechnology Industry Research Assistance Council) reviewing research projects for funding. As chairman of the scientific committee, he has played a key role in organizing eight annual international conferences on "Transforming Healthcare with ICT'. He has overseen setting up telemedicine units at 14,000 ft. height in the Himalayas for the Himachal Pradesh Government. Columbia University had selected ATNF as a case study to demonstrate global best practices. Full CV available at http://www.kganapathy.com.

KEYNOTE LECTURES

Title: Artificial Intelligence in Ophthalmology - Machines Vs. Human
Date: September 21, 2019
Time: 11:30 – 11:45

Deep learning system (DLS) represents an advancement of artificial neural networks that permit improved accuracy on the classification on image data. Therefore, it has been proposed as an alternative method for screening program. However, the appreciation on this improvement on accuracy in DLS would need to be understood in the context of the fact that in real-world screening programs, human graders or general ophthalmologists may also make mistakes. In this lecture, we will present the results on a direct comparison on the accuracy of human graders and DLS in real-world settings and further discuss its implication on screening programs in the future.

Prof. Mingguang HE

Professor of Ophthalmic Epidemiology, Centre for Eye Research Australia

Prof. Mingguang He is currently Professor of Ophthalmic Epidemiology in University of Melbourne and Centre for Eye Research Australia, Director of WHO Collaborating Centre for Prevention of Blindness (Australia). He is the former Associate President and Professor of Ophthalmology in the Zhongshan Ophthalmic Center (ZOC), Sun Yat-sen University in Guangzhou, China. He completed his medical school and clinical training in Sun Yat-sen University of Medical Sciences and ZOC. He received his research training in Johns Hopkins University (MPH) and University College London (MSc PhD).

After joining the faculty at University of Melbourne in October 2014, he has received research grant support from BUPA Health Foundation, Google Impact Challenge, Medical Research Future Fund, NHMRC partnership grant and many other collaborative funds from China, in total of more than $1 million funding support. He developed a team of 13 researchers, 4 research scientists and 8 visiting students, dedicating to artificial intelligence and big data research.

He found and served as the first president of the Asia Pacific Tele-Ophthalmology Society. This society has become a member of Asia Pacific Academy of Ophthalmology and has successfully organized three annual meetings in Beijing, Hong Kong and most recently in Singapore, attended by prominent companies and researchers from all over the world, including the Google and Apple and US FDA. He also served as the founding council member to establish the Asia Pacific Myopia Society. He serves as editorial board member for several important journals, including the Ophthalmology, the Top 1 ophthalmology journal.

He ran the world first real-world study on deploying artificial intelligence to enable diabetic retinopathy screening at endocrinology and primary care settings in the world. This work has led to publications in JAMA, Diabetes care and Ophthalmology and attracted media report from Herald Sun.

He collaborated with the Sax Institute to build a team of big data researchers to run the 45 and Up study analysis that involved around 250K people enrolled in New South Wales where a variety of prediction models, based on traditional random forest and novel deep learning model, have been developed for diabetic retinopathy, ageing, diabetes and multiple chronic diseases. His research has led to more than 60 publications as senior author in peer-reviewed journals, including JAMA (2015), JAMA (2017), Lancet (2019) and monthly highlight article in JAMA Ophthalmology, several invited editorial papers in Ophthalmology. These papers have attracted more than 10600 citations with H-index 50 (Google scholar).
His research has led to a white paper published by World Health Organization on myopia control among school-aged children. His publication on JAMA Ophthalmology 2018 was highlighted by the Independent, a UK media in a report. This report attracted attention from China President Xi Jinping, which led to a nation-wide policy and 5-year strategic planning on myopia control in China. He has received several awards including the Holmes Lecture Award from the Asia-Pacific Academy of Ophthalmology (2015), Richard Fan Distinguished Lectureship granted by Singapore National Eye Centre (2018) and Raine Visiting Professor Award from University Western Australia (2014).

KEYNOTE LECTURES

Title: Screening Through Tele Ophthalmology to Prevent Diabetic Blindness (S.T.O.P Blindness), Jyot se Jyot Jhalao - An AIOS initiative
Date: September 22, 2019
Time: 12:00 – 12:15

Prof. Dr. S. NATARAJAN

President, All India Ophthalmological Society

Prof. Dr. S. Natarajan, Padmashree Awardee (one of the highest civilian Award by the President of India),is an ophthalmologist who has dedicated his life for bringing back the light in the eyes. Over last 34 years, he has performed over 30000 exclusive Vitreo-retinal surgeries. Dr Natarajan has trained 70 Vitreo-retinal surgeons across the globe. Dr. Natarajan performed more than 200 complicated VR surgeries on pellet injury patients and in 2 ½ days he performed record 47 VR surgeries continuously which is itself a noble thing for humanity, GOVERNMENT OF JAMMU AND KASHMIR has declared "State Award to Prof Dr S Natarajan for his Meritorious Public Service". Multiple articles on Dr. S. Natarajan's dedication and commitment towards the service done for the ocular trauma victims in Kashmir in The New York Times and many other newspapers and magazines all over the world.

Charter inductee in Retina hall of fame only two Indians are there in that list, Dr Natarajan & Dr S S Badrinath, His Guru (from Sankara Nethralaya , Chennai) along with the pioneers in the field of ophthalmology like Dr Charles Schepens (The father of modern retinal surgery), Allvar Gullstrand (who got Noble Prize in Ophthalmology), Dr Jules Gonin (who pioneered the procedure of ignipuncture, the first successful surgery for the treatment of retinal detachments), Dr Helmholtz who invented ophthalmoscope etc.

The Prestigious International Council of Ophthalmology has appointed him as ICO Board of Trustees for 2018-2020.

The SAARC Academy of Ophthalmology (SAO) honored him with "SAO Excellence Award" for the 2018.

Prof. Dr. S. Natarajan has been invited as a Coordinator for the World Forum of Ophthalmological Journal Editors program at the WOC2018.

He is invited to teach as well as speak in prestigious universities across the globe and his work has been published in hundreds of international journals. He has presented 1,376 invited guest lectures, highest number in the world. He has 116 publications in journals. He has written two Books, 7 chapters in books. He is honored with D Sc from Saveetha University.

In last three decades, he has served in various capacities on the prestigious world-renowned organizations. At present he is President of International Society of Ocular Trauma Asia-Pacific Ophthalmic Trauma

Society, Ocular Trauma Society of India and President of All India Ophthalmological Society (AIOS).

He is also recipient of several other international awards for his exemplary work in the medical field (Ophthalmology) which includes "Gusi Peace Przie, Philippines, "Man of the Millennium (Ophthalmology)" Award By the Wisitex Foundation, "Distinguished Service Award" bestowed by the Asia Pacific Academy of Ophthalmology (APAO) APAO congress in Singapore as well as Busan Korea, Special recognition and Senior Achievement award by the American Academy of Ophthalmology & "Icon-06 Young Achiever" Award for his outstanding Clinical & Scientific Contribution made in the field of Ophthalmology, Spirit of Humanity Award 2015, FICO Hons. From the International Council of Ophthalmology and Doctor of Science (Honorius Causa) from Saveetha University for his contributions in the field of Ophthalmology.

Dr Natarajan established a non-profitable Public Charitable Trust, Aditya Jyot Foundation for Twinkling Little Eyes in 2005. The initiative sowed seeds during visit of Dr A P J Abdul Kalam, former President of India on his visit to eye hospital founded by Dr Natarajan. The Foundation runs outreach programs in rural and urban slums and tribal areas that strives to provide quality eye care for the underprivileged. Aditya Jyot Diabetic Retinopathy Urban Mumbai Slum Study (AJ-DRUMSS) which is funded by the World Diabetic Federation and Sir Dorabji Tata trust with specific focus is to understand the genetic profile of diabetic patients to prevent blindness.

The Foundation has run Several hundreds of Diabetic Retinopathy camps and screened over 70,000 people and over 60,000 children screened in school screening programs. Through the door to door campaign the Foundation has covered over 2,00,000 households and over ONE MILLION people in slums and performed over 5000 free surgeries. In Association with AIOS, he has started initiative STOP BLINDNESS which is a free diabetic retinopathy screening across the country. The Aditya Jyot Foundation is committed to reduce both avoidable and unavoidable blindness and has also established R&D Unit. Our vision is to establish cutting edge research and technology to understand the bio-mechanism of eye diseases and to discover novel therapeutic approaches including regenerative medicine.

The most diabetic eye screenings in 8 hours is 649, and was achieved at an event organised by Prof. Dr. S. Natarajan, Dr. Radhika and Aditya Jyot Foundation for twinkling Little Eyes (All India, in Dharavi, India, on 2nd February 2019.

Prof. Dr. S. Natarajan is a third-generation ophthalmologist, son of Prof Dr. N. S. Sundaram, who was his inspiration in starting various clinics in Maharashtra and Chennai. All three of them studied in Govt. Ophthalmic Hospital & Regional Institute of Ophthalmology, Madras. The clinic in Chennai is dedicated towards research in the field of Hereditary Eye Diseases.

He is visiting professor in -

1. Marmoindes University, Argentina,
2. ESASO, University of Lugano, Switzerland,
3. Balaji Medical College, Chennai, India
4. Saveetha Medical University, Chennai, India.

KEYNOTE LECTURES

Title: AI in Health Care
Date: September 21, 2019
Time: 11:45 – 12:00

Deep learning has shown a lot of promise in healthcare, in particular for a variety of medical imaging applications such as for the detection of melanoma, breast cancer, lung cancer, and eye disease. Often the algorithms trained have comparable accuracy to human experts. This talk covers clinical and technical considerations in applying deep learning to retinal imaging to build high performing and clinically relevant models. It will also cover how deep learning can be leveraged to make novel predictions such as disease progression.

Dr. Lily PENG

Product Manager,
Google Health

Dr. Peng is a physician-scientist and product manager for Google Health. She and her team focus applications of deep learning, especially for medical imaging. Some of her team's recent work includes building models to detect diabetic retinopathy at physician-level accuracy, predicting cardiovascular health factors from retinal images, detecting breast cancer metastasis from histopathology slides, and lung cancer from screening CT scans. Before working at Google, Dr. Peng was a product manager at Doximity, the "LinkedIn for physicians." She is a co-founder of Nano Precision Medical (NPM), a medical device start-up that has developed a small implantable drug delivery device. She earned a Bachelor of Science degree with honors and distinction in chemical engineering from Stanford University, California. She then earned a doctorate in bioengineering and a medical degree from the University of California, San Francisco.

YOUNG INNOVATOR TRAVEL GRANTS

Every year, the Asia Pacific Tele-Ophthalmology Society offers up to 3 travel grants for outstanding presenters and young innovators to attend its annual symposium. Priority is given to young innovators who are aged 40 or below, come from a developing country, whose presentations (free paper or poster) have been accepted by the Scientific Program Committee and who have never received the APTOS Young Innovator Travel Grant.

Jessica C. DAZA-ROBES, MD
Philippines

Quang Ngoc NGUYEN
Vietnam

Ashwini ROGYE
India

BIG DATA COMPETITION

In this synchronous Kernels-only competition, participants built a machine learning model to speed up detection of diabetic retinopathy, the leading cause of blindness among working aged adults. Competing teams worked with thousands of images collected in rural areas by Aravind Eye Hospitals to help identify diabetic retinopathy automatically. Participants not only help to prevent lifelong blindness, their models may also be used to detect other sorts of diseases in the future, like glaucoma and macular degeneration.

Fully supported by Kaggle, the Competition had attracted 3,588 competitors from around the world for form 2,987 teams. Together, they submitted over 63,000 entries. Below is a snapshot of the private leaderboard. The results are not yet finalized. Join us at the Opening Ceremony and the "Tele-Ophthalmology Challenge" session to congratulate and to learn from experiences of the winning teams.

In the money · Gold · Silver · Bronze

#	△pub	Team Name	Notebook	Team Members	Score	Entries	Last
1	▲5	Guanshuo Xu			0.936	118	2d
2	▼1	WAIR			0.935	317	3d
3	▲5	QAQ			0.934	110	3d
4	▲7	[ods.ai] Eye of Private LB			0.934	177	2d
5	▲5	Zihan Huang			0.933	99	6d
6	▲7	[ka.kr] Save our eyes			0.933	264	2d
7	▲13	Best Over Fitting			0.933	151	4d
8	▲1	Lucky time			0.933	123	2d
9	▼7	[ods.ai] topcoders			0.933	176	6d
10	▲2	[ods.ai] Eugene Khvedchenya			0.933	132	2d
11	▲12	Eye of Stars			0.932	244	2d
12	▲16	The Zoo			0.931	276	2d
13	▼8	[kaggler-ja] CMY			0.930	203	2d
14	▲43	4ui_iurz1			0.930	81	2d
15	▲3	The luckiest one !			0.930	312	2d
16	▼1	Igor Praznik			0.930	189	3d
17	▲14	[ods.ai] Eye for an eye			0.930	270	2d
18	▲9	Q			0.930	132	4d
19	▲127	CarlosPK			0.930	183	3d
20	▲67	Good game, well played!			0.930	89	2d

SEPT 21, 2019 (SAT)

TELE-OPHTHALMOLOGY

Notes from the Filed in Using Tele-Ophthalmology

09:00 - 10:00 Venue: Rajendra Hall 7 & 8
*Chair(s): Senthil **TAMILARASAN**, Angus **TURNER***

*09:00 **Technology-Driven Primary Eye Care***
*Ganesh **BABU***
*09:10 **Tele-Ophthalmology in the US***
*Ingrid **ZIMMER-GALLER***
*09:20 **Tele-Screening for ROP***
*Parag **SHAH***
*09:30 **Keynote: Challenges of Setting Up a Telemedicine Program***
*Rebecca **CANINO***
*09:45 **Panel Discussion***

Global Tele-Ophthalmology Initiatives

11:30 - 13:10 Venue: Rajendra Hall 7 & 8
*Chair(s): Robert **CHANG**, Yogesan **KANAGASINGAM***

*11:30 **Keynote: Artificial Intelligence in Ophthalmology – Machine Vs. Humans***
*Mingguang **HE***
*11:45 **AI in Healthcare***
*Lily **PENG***
*12:00 **Early Detection of DME: An Unmet Need That AI Can Solve?***
*Paisan **RUAMVIBOONSUK***
*12:10 **AI-Based Diabetic Retinopathy Screening in Primary Care Physician Settings in Australia and Singapore***
*Yogesan **KANAGASINGAM***
*12:20 **Primary Eye Care Enabled by AI: Connecting Healthcare Professionals***
*Jack **TAN***
*12:30 **On the Role of Statistical Certainty in Ophthalmic Screening and Diagnosis***
*Gabriela **CZANNER***
*12:40 **Using AI to Predict Systemic Factors from Retinal Images***
*Tyler **RIM***
*12:50 **Panel Discussion***

ARTIFICIAL INTELLIGENCE

Roundtable

14:00 - 15:30 Venue: Rajendra Hall 7 & 8
*Moderator(s): Robert **CHANG***

*14:00 **Keynote: Natural Language Processing Advancements in AI***
*Robert **CHANG***
*14:15 **Roundtable Discussions: "AI – Solving Today's Problem & Opening New Frontiers"***
*Panelist(s): Rebecca **CANINO**, Mingguang **HE**, Rajiv **RAMAN**, Gavin **TAN**, R.D. **THULASIRAJ***

TELE-OPHTHALMOLOGY

Techno-Clinical Alliance in Tele-Ophthalmology

16:00 - 17:30 Venue: Rajendra Hall 7 & 8
*Chair(s): Sheila **JOHN**, Kasumi WIDNER*

*16:00 **Leaveraging Modern Technologies Including AI for Advances in Ophthalmology***
*Vimal **WAKHLU***
*16:15 **Predicting Cardiovascular Signals from Fundus Photographs***
*Pinal **BAVISHI***
*16:25 **Entrepreneurship in Tele-Ophthalmology – My Story***
*Senthil **TAMILARASAN***
*16:35 **Modularity of ML Applications and Auto ML***
*Ce **ZHANG***
*16:45 **Tele-Ophthalmology: Mobile Eye Care Services***
*Sheila **JOHN***
*16:55 **AI for Glaucoma in Primary Settings***
*Yogesan **KANAGASINGAM***
*17:05 **Fundus Camera in Tele-Screening***
*K. **CHANDRASEKHAR***
*17:15 **Panel Discussion***

SCIENTIFIC PROGRAM SCHEDULE

SEPT 22, 2019 (SUN)

ARTIFICIAL INTELLIGENCE

AI Applied Stage

10:30 - 12:00 Venue: Rajendra Hall 7 & 8
Chair(s): R. ***RAJALAKSHMI****, Naama* ***HAMMEL***

10:30 ***Keynote: AI in Neurosciences***
Krishnan ***GANAPATHY***
10:45 ***AI in Clinical Workflow***
Kim ***RAMASAMY***
10:55 ***Translating AI Research into a Healthcare Product***
Sunny ***VIRMANI***
11:05 ***Use of Artificial Intelligence in Tele-Retinal Screening for Diabetic Retinopathy in Emerging Economies***
R. ***RAJALAKSHMI***
11:15 ***AI in Glaucoma***
Naama ***HAMMEL***
11:25 ***Real Time Experience in DR Automatic Screening with AI (DART) in the Chilean NHS***
K. ***CHELLARANI***
11:35 ***Computer Vision to Detect Glaucoma***
Reza ***ZADEH***
11:45 ***Panel Discussion***

Regulations & Policies in Using AI in Tele-Ophthalmology

12:00 - 13:30 Venue: Rajendra Hall 7 & 8
Chair(s): Gavin ***TAN****, Ingrid* ***ZIMMER-GALLER***

12:00 ***Keynote: Screening Through Tele Ophthalmology to Prevent Diabetic Blindness (S.T.O.P Blindness), Jyot se Jyot Jhalao - An AIOS initiative***
Sundaram ***NATARAJAN***
12:15 ***Our Own Integration and Regulatory Experience with Implementing AI into our DR Screening Program in Singapore***
Gavin ***TAN***
12:25 ***AI: Sweet Spot for Everybody?***
Richel ***LIU***
12:35 ***Developing AI based digital health solutions – Ethical, Legal & Regulatory Challenges***
Ganesh ***BABU***
12:45 ***Telemedicine in ROP***
Anand ***VINEKAR***
12:55 ***Leveraging AI for Universal Eye Health***
R. D. ***THULASIRAJ***
13:05 ***Role of Teleophthalmology in taking eye care to the rural population of Bangladesh***
Golam ***MOSTAFA***
13:15 ***Panel Discussion***

TELE-OPHTHALMOLOGY

Tele-Ophthalmology Challenge

14:30 - 16:00 Rajendra Hall 7 & 8
Chair(s): Maggie ***DEMKIN****, Dushyantsinh* ***JADEJA***

14:30 ***Keynote: How We Did It? Kaggle***
Maggie ***DEMKIN***
14:45 ***Big Data Competition Presentations***
Winning Teams
15:30 ***Panel Discussion***

SUBMITTED PROGRAM- FREE PAPERS

SEPT 22, 2019 (SUN)

FREE PAPER SESSION 1

08:30 - 10:00 Venue: Rajendra Hall 7 & 8
*Chair(s): Mingguang **HE**, Sangchul **YOON***
*Moderator(s): Karthik **SRINIVASAN***

08:30 ***Challenges of Designing AI based Systems Used for Ophthalmic Screening Solution***
*Krunalkumar R. **PATEL***
08:38 ***Visual Explanation of Abnormality in Fundus Images Using Gradient-Weighted Class Activation Maps***
*Dhivakar **KANAGARAJ***
08:46 ***Comparison of Artificial Intelligence (AI) Results on Optic Disc Parameters to Specialist Marking on Digital Fundus Images***
*Rekha **SHARMA***
08:54 ***The Effect of the Privacy and Secure AI, Federated Learning to the Performance***
*Hiroki **MASUMOTO***
09:02 ***To Evaluate the Performance of Medios AI system in Detecting Referable DR on Images Taken by a Minimally Trained Health Worker***
*Ashwini **ROGYE***
09:10 ***Multilabel Dataset of Retinal Images for Detection of Multiple Ocular Diseases***
*Quang Ngoc **NGUYEN***
09:18 ***Multimodal and Multi-Categorical Retinal Image Classification Using Convolutional Neural Network***
*Danli **SHI***
09:26 ***Deep Eye: A Local Approach of Deep Learning for Macular Edema and Macular Degeneration Diagnosis in Brazil***
*Fabio B. **NOGUEIRA***
09:34 ***Towards an Instantaneous, On-Device Cup-to-Disk Ratio Estimator for the Remidio Fundus-on-Phone***
*Florian M. **SAVOY***
09:42 ***Validation of Results of Age-Related Macular Degeneration (AMD) Classification by Artificial Intelligence (AI) Algorithm Against Specialist Verification on Digital Fundus Images***
*Rekha **SHARMA***
09:50 ***Validation of Retinal Image Grading Results by a Trained Non-Ophthalmologist Grader for Detecting Diabetic Retinopathy in Southern India***
*Sanil **JOSEPH***

FREE PAPER SESSION 2

16:30 - 18:00 Venue: Rajendra Hall 7 & 8
*Chair(s): Mingguang **HE**, Rajiv RAMAN*
*Moderator(s): Karthik **SRINIVASAN***

16:30 ***Voice-Enabled Digital Assistance System for Ophthalmologists***
*Dhivakar **KANAGARAJ***
16:38 ***Addressing Barriers to Ophthalmic Services in Rural Western Australia: An Audit of an Outreach Ophthalmology and Tele Ophthalmology Service***
*Angus **TURNER***
16:46 ***Inter Grader Variability in Diabetic Retinopathy***
*Bhavana **SOSALE***
16:54 ***Telemedicine Screening of the Prevalence of Diabetic Retinopathy Among Type 2 Diabetic Filipinos in the Community***
*Jessica **DAZA-ROBES***
17:02 ***Trash to Treasure : Promoting Eye Health with Discarded Smartphones***
*Holden **KIM***
17:10 ***Cup-to-Disc-Ratio Estimation Based on Deep Learning for Glaucoma Diagnosis***
*Kangrok **OH***
17:18 ***Performance of the Offline Medios AI Algorithm on Non-Mydriatic Smartphone-Based Two Field Fundus Images in Assessing the Severity of DR***
*Bhavana **SOSALE***
17:26 ***Diabetic Retinopathy Grading on Fundus Photographs by Allied Medical Personnel as Compared to Ophthalmologist at Community DR Screening in Nepal***
*Raba **THAPA***
17:34 ***Diabetic Retinopathy Among Diabetics Attending Eye Camps in a Diabetic Hospital of Northern Bangladesh***
*Md. Sajidul **HUQ***
17:42 ***Validation of Deep Learning Algorithm Based Optic Disc Evaluation for Glaucoma in a Tertiary Eye Care Hospital***
***Harshavardhan** V K*
17:50 ***Validation of Results of OCT Macula Categorisation by Artificial Intelligence (AI)***

Algorithm Compared to Specialist Labelling
Thirumalesh ***M B***
17:58 ***Expanding Potential of Near-Infrared Fundus Cameras with Multispectral Imaging***
Hironari ***TAKEHARA***

SUBMITTED PROGRAM- E-POSTER

ARTIFICIAL INTELLIGENCE

Acceptability of Artificial Intelligence-Based Fundus Screening Amongst General Population
*First Author: Divyansh **MISHRA***
*Co-Author(s): Mahesh **SHANMUGAM**, Payal **SHAH**, Rajesh **R.**, Hari **PRASAD***

Accuracy of a Deep Learning System for the Detection of Myopic Maculopathy on the Basis of Color Fundus Photographs
*First Author: Ruilin **XIONG***
*Co-Author(s): Zhixi **LI**, Guankai **PENG**, Chi **LIU**, Mingguang **HE***

An Artificial Intelligent Platform for Live Cell Identification and the Detection of Cross-Contamination
*First Author: Ruixin **WANG***
*Co-Author(s): Dongni **WANG**, Meimei **DONGYE**, Xiayin **ZHANG,** Haotian **LIN***

Automated Grading of Age-Related Macular Degeneration on Color Fundus Images Using Deep Convolutional Neural Networks
*First Author: Chimei **LIAO***
*Co-Author(s): Zhixi **LI**, Chi **LIU**, Mingguang **HE***

Automated Classification System of Retinal Arteriosclerosis Bsed on Fundus Photographs
*First Author: Yixiong **YUAN***
*Co-Author(s): Zhixi **LI**, Guankai **PENG**, Wei **MENG**, Mingguang **HE***

Detecting Other Eye Conditions with Artificial Intelligence in Singapore's Diabetic Retinopathy Screening Programme
*First Author: Jinyi **HO***
*Co-Author(s): Haslina **HAMZAH**, Raudhah H. **MOHAMED**, Kelvin **TEO**, Daniel **TING**, Tien Yin **WONG**, Gavin **TAN***

Estimation of Blood Pressure Through Fundus Photograph-Based Deep Learning Model in a Chinese Population
*First Author: Wei **WANG***
*Co-Author(s): Yu **JIANG**, Chi **LIU**, Mingguang **HE***

Efficacy of a Deep Learning System for Detecting Choroidal Neovascularization Based on Optical Tomography Images
*First Author: Zhuo **ZHU***
*Co-Author(s): Zhixi **LI**, Guankai **PENG**, Chi **LIU**, Mingguang **HE***

BIG DATA ANALYTICS

Artificial Intelligence Deciphers Codes for Color and Odor Perceptions Based on Large-Scale Chemoinformatic Data
*First Author: Xiayin **ZHANG***
*Co-Author(s): Kai **ZHANG**, Duoru **LIN**, Ruixin **WANG**, Haotian **LIN***

CATARACT

A Study on Incidence of Dry Eye Following Small Incision Cataract Surgery
*First Author: Keerthi Sri **A. S.***
*Co-Author(s): Kuppam **PESIMSR***

A Study on Occurrence of Post-Operative Complications Following Small Incision Cataract Surgery
*First Author: Keerthi Sri **A. S.***
*Co-Author(s): Kuppam **PESIMSR***

DEEP LEARNING

An Automated Aided Diagnosis System for Detection of Diabetes Mellitus Based on Color Fundus Photographs
*First Author: Yu **JIANG**,*
*Co-Author(s): Chi **LIU**, Guankai **PENG**, Mingguang **HE***

Automated Detection of Diabetic Macular Edema in Optical Coherence Tomography Using Deep

Learning
*First Author: Zhixi **LI***
*Co-Author(s): Guankai **PENG**, Wei **MENG**, Mingguang **HE***

GLAUCOMA

Role of Remote Monitoring of Diurnal Variation in the Diagnosis and Follow-Up of Open Angle Glaucoma in a Tertiary Health Care Centre
*First Author: Mayuresh **NAIK***

RETINA & VITREOUS

A Case Report on Idiopathic Retinal Vasculitis, Aneurysms and Neuroretinitis (IRVAN) Syndrome
*First Author: Keerthi Sri **A. S.***
*Co-Author(s): Kuppam **PESIMSR***

TELE-OPHTHALMOLOGY

Offline Artificial Intelligence (AI) Assisted Detection of Referable Diabetic Retinopathy
*First Author: Sivaranjani **S***
*Co-Author(s): Manavi D. **SINDAL**, Kurian **JOSS**, Anand **SIVARAMAN***

Tackling the Challenges of Internet Bandwidth Connectivity for Teleophthalmology in Rural Locations in India
*First Author: Mukesh **TANEJA***
*Co-Author(s): Shravani **M**, Jagadesh **RAO**, Ashutosh **RICHARIYA**, Jean-Marie **PAREL***

Tele-Screening and Sterio-Imaging in Diabetic Retinopathy Patients from Remote Distant Communities
*First Author: Tejeswara **DHUPAM***

UVEITIS

A Case of Multiple Infectious Retinochoroiditis in an Immunocompromised Male: A Case Report
*First Author: Jessica **DAZA-ROBES***

SUBMITTED PROGRAM- VIDEOS

RETINA & VITREOUS

Management of a Case of Chronic Cyclodialysis Cleft Repair Using Innovative Sewing Machine Technique
*First Author: Divyansh **MISHRA***
*Co-Author(s): Mahesh **SHANMUGAM**, Rajesh **R.**, Bindiya **DOSHI***

TELE-OPHTHALMOLOGY

Using Retcam Based Tele-Ophthalmolmic Imaging in Enhancing Retinopathy of Prematurity Screening and Referral and Treatments In Rural Peripheral Ophthalmic
*First Author: Tejeswara **DHUPAM***

FREE PAPERS

ARTIFICIAL INTELLIGENCE

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

Challenges of designing Artificial Intelligence (AI) based systems used for Ophthalmic screening solution

First Author: Krunalkumar Ramanbhai ***PATEL***
Co-Author(s): Sandipan ***CHAKROBORTY****, Dhivakar* ***KANAGARAI***

Objective: AI based ophthalmic screening solutions offer automation eliminating the reading cost, and the delay due to manual processing of patients' reports. In this abstract, we describe real-time challenges faced while designing such an AI system.
Methods: As mentioned above, the various challenging parameters are;
1) Composition of training data
More the diverse data, the better generalization achieved by the Deep Neural Network (DNN). The challenge here to get the diversity, which requires different acquisition devices, varied ethnicity, varied age range etc.
2) Insufficient quality of data
The poor quality of data as well as their ground truths may confuse a DNN resulting in higher training error.
3) Data pruning protocol
A dataset may contain multiple scans of the same eye. If not deduplicated the DNN may start learning the structure of the retina rather than disease.
4) Time versus a model foot print versus performance
Combining multiple learning models help to achieve higher performances than those of individual models. Linear combination of multiple DNNs' score may improve the classification accuracy but at the expense of execution time and the memory foot-print.
5) Number of parallel requests
For the mass screening application, there will be multiple requests to use the AI as a service, which comes as a form of parallel request - serving to those requests might overload the system.
Results: Results are shown in Fig 1.
Conclusions: We demonstrated the effect of various parameters for AI based Ophthalmic solutions. Based on the system requirement the careful selection of these parameters is essential.

Keywords: Artificial Intelligence (AI), Ophthalmic screening solution, Deep Neural Network (DNN)

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

Comparison of Artificial Intelligence (AI) results on Optic Disc parameters to specialist marking on digital fundus images

First Author: Rekha ***SHARMA***

Objective: To identify the degree of concordance between AI analyser output to marked boundaries by specialists using parameters: 1) Mean Absolute Error (MAE), DICE score, percentage in disc & and cup image segmentation 2) Sensitivity, Specificity & precision for ISNT Rule validation 3) Cup symmetry - asymmetry labeling compared to image (majority) ground truth.
Methods: Retrospective study of 384 anonymised fundus images, with independent separate evaluation by Algorithm and four ophthalmologists.
Results: Prediction accuracy for model compared to consultants in segmentation mask for average disc DICE score was 93.9% with Interobserver variability (IOV) of above 95% and for average cup DICE score was 82.56% with IOV of 82.50%. MAE between Model and marked vertical CDR (VCDR) was 0.073; IOV being 0.085 and for Horizontal CDR (HCDR) was 0.091; IOV being 0.091. 95% Confidence Interval (CI) of VCDR MAE is 0.073+/-0.004 and HCDR MAE is 0.091+/- 0.004. ISNT violation (ISNTV) predictions based on calculated pixel distances did not match Consultant marking. Model concurred for symmetry label in 153 cases with precision (PPV) 97.4 and sensitivity 99.4%. Model concurred for Asymmetry in 7 cases with PPV 75% and sensitivity 42.9%. The surveyed metrics were <0.05.
Conclusions: AI module has good accuracy and tallies for prediction of HCDR, VCDR and cup symmetry with ophthalmologists. The detection of ISNT violation detection was not collaborative to Consultant opinion. The outcome has favourable implications for glaucoma screening.

Keywords: Artificial Intelligence,Glaucoma ,MAE,DICE

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

Multilabel Dataset of Retinal Images for Detection of Multiple Ocular Diseases

First Author: Quang Ngoc ***NGUYEN***
Co-Author(s): Hoa ***NGUYEN****, HT* ***NGO***

Objective: To establish the first multi-label fundus dataset with 7 retinal conditions, providing the base for the detection of retinal diseases using Artificial Intelligence.

Methods: The dataset was collected from a private hospital in Vietnam, Cao Thang International Eye Hospital in the period of 6 years, from 2013 to 2018. The dataset was de-identified, cleaned up and matched up with the corresponding Electrical Medical Records. All terms were standardized and in compliance with ICD-10.
Results: A total of 6,871 fundus images were collected. The dataset includes 7 abnormal conditions of the eye: Cataract, Diabetic Retinopathy, Macular Edema, Glaucoma, Macular Degeneration, Retinal Vascular Occlusion, Optic Neuritis/Neuropathy and "Others," "Others" comprises of following 15 conditions: Posterior Uveitis, Eye Infections, Macular Pucker Vitreous/Retinal Hemorrhage, Posterior Capsular Opacification, Retinal Detachments/Breaks, Laser Scars, Hereditary Retinal Dystrophy, Myopia, Other Disorders On Fundus, Central Serous Chorioretinopathy, Glaucoma Suspect, Hypertensive Retinopathy, Chorioretinal Atrophy, Large Cup, and Chorioretinal Neovascularization. More importantly, each fundus image can have more than 1 condition, leading to a total of 59 combinations of diseases in the dataset.
Conclusions: The dataset has 2 unique characteristics: first, it includes 7 distinct retinal diseases; second, it is multi-labeled, meaning that a fundus image in the dataset can associate with multiple retinal diseases at the same time. The dataset's uniqueness and high variation in diseases and their combinations can be a useful source for many studies using Deep Neural Networks to detect more retinal diseases, extending the capabilities of Artificial Intelligence in Ophthalmology.

Keywords: multi-label dataset, fundus image, artificial intelligence

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Voice Enabled Digital Assistance System for Ophthalmologists

*First Author: Dhivakar **KANAGARAJ***
*Co-Author(s): Ramachandra **KAVYA**, Sandipan **CHAKROBORTY**, Ashish **MODI***

Objective: In present days, busy ophthalmologists spend a lot of time updating and retrieving Electronic Health Records (EHR) manually. Voice is one of the natural modalities that can be used to perform the above tasks with minimal manual intervention. In this abstract, we propose to use voice with Natural Language Processing (NLP) as tools to extract the fields of interest from a large database using Structured Query Language (SQL) to save time for doctors.
Methods: We customized a Google speech recognition application interface (API) by adding ophthalmic context words. The doctor submits a speech sample, which is transcribed by the API. The transcribed speech goes through several NLP operations such as tokenization, glue word rejection, part-of-speech detection to determine semantic content of the spoken sentences. The processed transcription is then converted to an SQL query using the knowledge base or Ontology and this query is finally used to retrieve the right content from a large patient database. The block diagram in Fig.1 describes the overall system.
Results: The word error rate of the speech recognition module was reduced to 2.9% when using with context words. The database query generation error rate is 2.5- 3%. The overall system shows 90% accuracy for an in-house database. Results are shown in Fig.2.
Conclusions: In this abstract, a semi-automated voice and NLP driven SQL query has been used to extract content specified by the doctor.

Keywords: Artificial Intelligence (AI), Deep Learning, Natural Language Processing (NLP), Speech Recognition

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

The Effect of the Privacy and Secure AI, Federated Learning to the Performance

*First Author: Hirioki **MASUMOTO***
*Co-Author(s): Masahiro **KAMEOKA**, Naofumi **ISHITOBI**, Shoto **ADACHI**, Hitoshi **TABUCHI***

Objective: These days, progress of neural network is remarkable, while the importance of confidentiality and data privacy has been increasing. Especially, Japan has enough medical resource and therefore these concepts are considered very important. The method called federated learning has been proposed for building private and secure AI. In this study, we compared the performance of neural networks for classification (Normal vs RD) between made in the situation an institution could gather the data from other institutions and made in the situation the data can't be shared across institutions.
Methods: Totally, 1906 ultrawide pseudocolor fundus images (953, Normal; 953, RD) of patients who visited the Department of Ophthalmology, Tsukazaki Hospital were used. We used 1556 images as training data and 390 images as test data. First, we trained the whole training data and made the one model (whole model). Second, we made the three training models with a third of the training data separately and average the three trained models together to one model (averaged

model).
Results: The Area Under the Curve (AUC), sensitivity, specificity of the whole model was 0.874(95%CI: 0.838 - 0.909), 77.9% (95%CI: 71.5 - 83.6%), 78.5% (95%CI: 72.0 – 84.0%), respectively. The AUC, sensitivity, specificity of the averaged model was 0.881(95%CI: 0.846 - 0.915), 80.5% (95%CI: 74.2 - 85.8%), 80.5% (95%CI: 74.2 – 85.8%), respectively.
Conclusions: The result suggests the possibility that we can make the AI with enough performance in the situation the data can't be shared and it smooth the difficulty of confidentiality in developing AI away.

Keywords: federated learning, privacy, confidentiality, retinal detachment

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

To Evaluate the Performance of Medios Artificial Intelligence System in Detecting Referable Diabetic Retinopathy on Images Taken by a Minimally Trained Health Worker

First Author: Ashwini ***ROGYE***
Co-Author(s): Radhika ***KRISHNAN****, Astha* ***JAIN****, Sundaram* ***NATARAJAN***

Objective: To evaluate the performance of Medios AI - an offline algorithm that can be used on a smartphone, to detect referable diabetic retinopathy on images taken on Remidio Fundus on Phone, a smartphone-based non-mydriatic retinal camera, in a large scale, prospective, clinical trial, using health workers with no prior experience In fundus imaging.
Methods: All diabetic patients visiting municipal dispensaries on a particular day were included, as part of a prospective cross-sectional study from August 2018 to April 2019. 1378 patients were screened for diabetic retinopathy using a mydriatic three-segment imaging protocol. All participants underwent fundus imaging using the Remidio fundus on phone camera. The images were analysed by ophthalmologist & subjected to an offline AI for detection of referable diabetic retinopathy (RDR).
Results: 1378 patients were screened, post dilation, 49 patients (3.5%) presented ungradable images from both eyes, 163 with images from at least one eye being ungradable (11.8%), 10 patients (<0.1%) with no image acquired in any eye and 24 patients (1.8%) with hazy media in at least one eye that prevented grading of images by the Ophthalmologist or the AI's quality check. Hence images from 1181 patients were analysed. The sensitivity and specificity of the AI in diagnosing RDR was 98% and 86.9% respectively and of any diabetic retinopathy as 89.8% and 90.7%.
Conclusions: The results show great promise in the use of an offline artificial intelligence with smartphone based retinal imaging, in community screening for referable diabetic retinopathy, using minimally trained health workers.

Keywords: Offline Artificial Intelligence, Diabetic Retinopathy, Community Screening, Untrained Photographers

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

Validation of results of Age Related Macular Degeneration (AMD) classification by Artificial Intelligence (AI)Algorithm against specialist verification on digital fundus images

First Author: Rekha ***SHARMA***

Objective: Comparison of AI module results to individual and majority ground truth for Non-Referable (Normal +Early) and Referable AMD (Intermediate + Advanced) categories by AREDS classification.
Methods: Retrospective clinical study evaluated anonymised fundus images of Retina OPD patients from time period June to Dec 2018.
Results: In 521 images Gradability model put 478 images as Gradable (sen-0.97 spec-0.74 PPV- 0.98) and 43 images as Nongradable (sens-0.74 spec-0.97 PPV- 0.72). Referable category was detected in 122 images with PPV- 0.89, sens -0.94 spec -0.91 while NonReferable AMD in 155 images with PPV-0.95 sens-0.92 spec -0.94. Receiver Operating characteristic (ROC) with Area under Curve (AUC) for Referable category - 0.91 and NonReferable- 0.88. Model classified Normal in 140 images (PPV-0.95 sens-0.95 spec0.91); Early in 15 (PPV 0.95 sens 0.60 spec 0.91); Intermediate in 35 (PPV- 0.89, sens- 0.91 spec-0.91) and Advanced categories in 87 images (PPV-0.89 sens- 0.95 spec- 0.91). Confidence Interval (CI) 95% for Referable was 0.95 ±0.030 and for NonReferable was 0.95 ±0.035. Interobserver variability (IOV) by weighted Fliess Kappa for any two consultants and AI model was 0.81. Surveyed metrics had a p-value of <0.05.
Conclusions: AI algorithm results for four stage AMD detection are credible being highly sensitive and specific. It can serve as a useful tool to prioritise referral of AMD cases for further evaluation.

Keywords: Artificial Intelligence AI ,AMD

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

Visual explanation of abnormality in Fundus images using Gradient-weighted Class Activation Maps

*First Author: Dhivakar **KANAGARAJ***
Co-Author(s): Alexander FREYTAG

Objective: A holistic retinal screening based on Fundus photographs is an important part of modern healthcare. To make the screening process faster, the fundus images are classified into normal or abnormal by an automated Deep Learning algorithm. When this automatically generated report is presented to a retina specialist via the referral, she/he may want to know why the case is positive. For making the system explainable ("transparent AI"), we propose to highlight the regions (lesion) which were responsible for the decision made.

DEEP LEARNING

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

Deep Eye: A Local Approach of Deep Learning for Macular Edema and Macular Degeneration Diagnosis in Brazil

First Author: Fabio B. NOGUERIA
Co-Author(s): Marcello F. PORTO, Rafael V. PICARRO, Bernardo F. C. CARVALHO

Objective: One of the biggest issues faced by the Brazilian poorest population is the difficulty in getting access to ophthalmology care centers, and the high cost of medical appointments and treatments. This is a great risk to many patients, once some diseases require immediate treatment to prevent sight loss. The objective of this project is to make the diagnosis of macular edema and macular degeneration more accessible and more agile, specially to the poor people, who live far from eye clinics.
Methods: We will gather OCT scan images. Once all image preparation is done, we will choose the best neural network, in which we are going to apply our data sets and train. Firstly, the machine recognizes the layers of the retina (image segmentation), present on the OCT scan, then it becomes able to give a diagnosis (image classification), based on the disposition of these layers.
Results: Development of a deep learning based software, capable to recognize macular edema and macular degeneration on OCTs scans. With this software, ophthalmologists will be able to transport scanners and necessary hardware even to isolated regions of the country, to give rapid diagnosis.
Conclusions: We believe that this project will help to improve health conditions in our country, saving people, especially the most disadvantaged communities, from losing vision because of difficulties to get ophthalmology care.

Keywords: macular edema, macular degeneration, OCT scans, deep learning

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

Multimodal and Multi-Categorical Retinal Image Classification Using Convolutional Neural Network

*First Author: Danli **SHI***
*Co-Author(s:): Mingguang **HE***

Objective To train a model to classify multimodal and multi-categorical retinal images, and explore the contributing features and optimization methods for retinal disease recognition.
Methods: A transfer learning approach was implemented to train a convolutional neural network (CNN) with a dataset of 14057 retinal images divided into 20 categories. Images were in five different modalities: color fundus photograph, fundus autofluorescence, fundus fluorescein angiography, indocyanine green angiography, and infrared reflectance. Dataset were collected from two devices: Zeiss FF450plus and Optos 200Tx.
Results: The model achieved a high level of performance on validation set and test set. The sensitivity, specificity and AUC were 94.8%, 100%, 0.99, respectively, on validation set. The sensitivity, specificity and AUC were 90.5%, 100%, 0.99, respectively, on test set. On MESSIDOR data set, the sensitivity was 62.3%, specificity was 100%. On E-Ophtha data set, sensitivity was 70.8%, specificity was 100%. Features learned by the CNN were becoming more complex as the layer became deeper, but they didn't represent the same kind of features that were expected in clinical practice.
Conclusions: This study shows that huge variations in image size and mode are well tolerated in CNN, it's feasible to train a model to recognize multimodal images. Despite trained on a relatively small data set, our model achieved a high level of performance on validation set and test set. Possible contributions might be the use of transfer learning and the sharing of features in different images.

Keywords transfer learning, multimodal retinal images, multi-categorical classification

Sept 22, 2019 (Sunday), 08:30 – 10:00
Venue: Rajendra Hall 7 & 8

Towards an instantaneous, on-device cup-to-disk ratio estimator for the Remidio Fundus-on-Phone

First Author: Florian M. ***SAVOY***
Co-Author(s): Krishna ADITHYA, Divya RAO

Objective: To determine the performance of a prototype of an automatic deep learning based cup-to-disc ratio (CDR) detector. The algorithm is designed to run offline on the Remidio Fundus-On-Phone (FOP) portable, low-cost fundus camera.
Methods: We trained a FPN segmentation network with a Resnet-18 backbone architecture. An algorithm estimates the CDR from the cup and disk output masks. We used a proprietary dataset collected with the Remidio FOP from a glaucoma center, curated to represent the quality characteristic of field images and segmented by a glaucoma specialist. 1613 images were used for training, and 380 images for testing. We also used the Drishti-GS (404 images) dataset for training.
Results: Of the 380 testing images, 4 outliers were removed from analysis. The mean CDR error was 0.054 (SD 0.047). 53 images (14.1%) had a CDR error of 0.1 or more and 6 images (1.6%) had a CDR error of 0.2 or more. Using the Bland-Altman's plot the average difference was -0.0069 and the 95% limits of agreement were -0.14 and 0.13. The algorithm runs in about a second when deployed on the Remidio FOP smartphone (without internet connection required).
Conclusions: Using this automated CDR detector, 98.4% of the evaluated images were within reported clinical inter-observer variability of less than 0.2 CDR. The promising results support further enhancement of this automated tool for glaucoma screening by adding other clinical determinants. An independent prospective validation of the algorithm needs to be performed before potential commercialization.

Keywords: Glaucoma, cup-to-disk, fundus image, deep learning

GLAUCOMA

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Validation of Deep Learning Algorithm based Optic Disc evaluation for Glaucoma in a Tertiary Eye Care Hospital

First Author: Harshavardhan ***V K***
Co-Author(s): Meena ***MENON***

Objective: To validate the ability of Artificial Intelligence (AI) based algorithm to assess cup-disc ratio (CDR), ISNT rule and Disc Damage Likelihood Scale (DDLS) in Optic Disc evaluation for glaucoma.
To compare the time taken for Optic Disc evaluation between AI and Glaucoma experts.
Methods: A total of 120 patients visiting a tertiary eye care hospital were enrolled for the study. Ethical committee approval was obtained and consent was taken prior to the imaging. Dilated 45^0 disc centered fundus photographs were captured using a fundus camera integrated with Netra.AI deep learning (www.leben.ai). Time taken for manual assessment and AI processing were noted. The results obtained by AI were compared with that of Glaucoma experts using Medcalc statistics and sensitivity, specificity and Kappa values were derived.
Results: Statistical analysis was performed for CDR, ISNT rule adherence and DDLS score between AI results and human grader. The range of agreement across parameters was found between 0.55 to 0.82 kappa. Sensitivity and Specificity of AI in detecting the likelihood of glaucomatous disc were found to be >80%. Time taken by Netra.AI was significantly less compared to manual evaluation.
Conclusions: Deep learning algorithm is a promising tool in quick and accurate disc assessment. It can be an excellent screening test at primary care levels thereby helping in early detection and management of glaucoma. With further research, AI can be potentially used in monitoring glaucoma progression.

Keywords: Deep learning, Artificial Intelligence, Glaucoma, Optic Disc

---

MACHINE LEARNING

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Cup-to-Disc Ratio Estimation Based on Deep Learning for Glaucoma Diagnosis

First Author: Kangrok ***OH***
Co-Author(s): Dawoon ***LEEM****, Hyungyu* ***LEE****, Hae Min* ***KANG****,Sangchul* ***YOON***

Objective: To investigate Cup-to-Disc Ratio (CDR) estimation based on deep learning for glaucoma diagnosis.
Methods: As image preprocessing, Contrast Limited Adaptive Histogram Equalization (CLAHE) is performed to increase the contrast of color fundus images. Subsequently, U-Net with pre-trained ResNet-18 model as the encoder is applied to train models for optic disc

and cup segmentation. Finally, CDR is estimated using the disc and cup segmentation results. We have utilized the publicly available REFUGE dataset for performance evaluation regarding optic disc and cup segmentation, CDR estimation, and glaucoma diagnosis tasks. We evaluate the segmentation results in terms of the mean dice score. For performance indicators regarding CDR estimation and glaucoma diagnosis, we adopt the Mean Absolute Error (MAE) and the classification accuracy in percentage. Additionally, color Ultra-Wide-Field (UWF) fundus images are utilized to test the trained optic disc and cup segmentation modules. For the additional experiments, we adopt an in-house dataset which consists of 1,421 UWF fundus images.
Results: From experiments using the REFUGE dataset, mean dice scores of 0.9417 and 0.8531 are obtained for the optic disc and cup segmentation tasks respectively. On the same dataset, we achieve an MAE of 0.0586 and classification accuracy of 96.75% for the CDR estimation and the glaucoma diagnosis tasks respectively. Additionally, we successfully segment the disc and cup for 97.5% of the in-house dataset.
Conclusions: In this study, we investigate optic disc and cup segmentation for CDR estimation and glaucoma diagnosis. From experiments using two datasets, we have achieved promising mean dice scores, MAE, and classification accuracy performances.

Keywords: glaucoma, CDR estimation, deep learning

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Performance of the Offline Medios Artificial Intelligence Algorithm on Non-Mydriatic Smartphone Based Two-Field Fundus Images in assessing the Severity of Diabetic Retinopathy

*First Author: Bhavana **SOSALE***
*Co-Author(s): Hemanth M. **SOSALE**, Srikanth **NARAYANA**, Usha **SHARMA**, Muralidhar **NAVEENAM***

Objective: The binary Medios offline Artificial Intelligence (AI) algorithm has previously been validated for referable diabetic retinopathy (RDR) and Sight Threatening Diabetic Retinopathy (STDR) on non-mydriatic images from the smart phone based Remidio Fundus-on Phone (NM FOP10). This study evaluates a new Medios grading-AI algorithm for the automated assessment of DR severity.
Methods: Non-mydriatic images were captured from 950 individuals with diabetes at Diacon Hospital, Bangalore. Two fields [posterior pole and nasal] were captured per eye on NM FOP 10 cameras. Five retinal specialists graded them using ICDR Severity Scale. Images were first classified by the Medios binary DR-NO DR algorithm. Those with DR were run on the severity-classifier algorithm from Medios Technologies, Singapore. AI classification was compared to the majority diagnosis of the ophthalmologists (ground truth).
Results: DR was present in 233 individuals. The Binary AI had a sensitivity and specificity of RDR of 93% (91.3%-94.7%), 92.5% (90.8%-94.2%); specificity for NO DR of 95.5% (94.1%-96.8%). The new severity-classifier AI correctly identified 51% of mild non-proliferative DR (NPDR), 31% with moderate NPDR, and had a high sensitivity and specificity for STDR 91.1% (89.2%-93%) and 90.7% (88.8%-92.6%). Diabetic macular edema (DME) detection sensitivity and specificity were 97.7% (96.7%-98.7%) and 91.5% (89.6%-93.3%).
Conclusions: The Medios binary AI had high sensitivity for RDR and high specificity for No DR. The Severity grading AI more accurately identified images with STDR, than those with mild and moderate NPDR. Inter-grader variability may explain this observation, and is the focus of a follow-on study.

Keywords: Diabetic Retinopathy, Artificial Intelligence, severity grading

---

RETINA & VITREOUS

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Diabetic Retinopathy among diabetics attending Eye camps in a Diabetic hospital of Northern Bangladesh

*First Author: Md. Sajidul **HUQ***
*Co-Author(s): Khairul **ISLAM**, Md. **SUMSUJJAMAN**, Md. Arifur **RAHMAN**, A. K. M. **SAIFULLAH**, Md. Faruck **HUSSAIN***

Objective: Diabetic retinopathy (DR) is one of the leading causes of vision loss which occurs as a result of micro-vascular complication of diabetes. The aim of the study is to assess the prevalence and factors associated with development of diabetic retinopathy among diabetic patients attending eye camps in a diabetic hospital of northern Bangladesh.
Methods: This was a population-based cross-sectional study, conducted through five comprehensive eye camps at diabetic association hospital in Nilphamari, Bangladesh. Previously diagnosed patients with Diabetes Mellitus attending eye camps were the sample of this study which included a total of 254 participants. All participants underwent complete eye examination to check for any

signs of DR with any other ocular abnormalities. Retinopathy was determined by fundus photography and direct ophthalmoscopy. Participants were also interviewed and examined to determine their demographic characteristics, clinical conditions, awareness on diabetic retinopathy and regularity of their eye visits.

Results: A total of 254 subjects were screened for diabetic retinopathy. Of them, 64 (25.2%) had diabetic retinopathy including, including 53 (20.9%) with non-proliferative retinopathy (NPDR) and 11 (4.3%) with proliferative diabetic retinopathy (PDR). Clinically significant macular edema (CSME) was detected in 7 patients (2.7%). The prevalence of diabetic retinopathy was higher among patients with greater duration of diabetes (p=< 0.001), poor glycemic control (p=0.002) and presence of hypertension (p=0.05).

Conclusions: Regular screening in patients with diabetes for early detection of diabetic retinopathy by effective screening program and increasing public awareness are highly recommended in Bangladesh.

Keywords: Diabetes mellitus (DM), Diabetic Retinopathy (DR), Prevalence

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Diabetic retinopathy grading on fundus photographs by allied medical personnel as compared to ophthalmologist at community diabetic retinopathy screening in Nepal

*First Author: Raba **THAPA***

Objective: The objective of the study is to assess the accuracy of diabetic retinopathy (DR) grading using fundus photographs by allied medical personnel (AMP) as compared to retina specialist at community diabetic retinopathy screening program

Methods: Fundus photographs were graded by six AMP after training and one retina specialist. Total of 1344 fundus photographs of each eye were graded twice at two weeks interval at three and six months of training. Agreement was assessed using kappa coefficient.

Results: The intra-rater agreement of AMP was at six months was substantial to almost perfect on normal versus abnormal retina, retinal hemorrhage, and exudates at macula, The agreement was almost perfect for detection of DR versus no DR and moderate to substantial for clinically significant macular edema (CSME) and other vision threatening DR.

There was substantial inter-rater agreement at six months on normal versus abnormal retina. The agreement was moderate for retinal hemorrhage, exudates at macula. The inter-rater agreement was substantial for detection of DR versus no DR, and moderate to substantial for CSME and VTDR. The agreement results were comparable at three months and six months of both intra-rater agreement and inter-rater agreement.

Conclusions: The inter-rater agreement of AMP and retina specialist on fundus photo grading was substantial for detection of DR and moderate to substantial for detection of VTDR. AMP can be utilized under the physician to integrate DR screening in comprehensive diabetes management in low resource country.

Keywords: Diabetic retinopathy, intra-rater agreement, inter-rater agreement, allied medical personnel

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Expanding potential of near-infrared fundus cameras with multispectral imaging

*First Author: Hironari **TAKEHARA***
*Co-Author(s): Hirofumi **SUMI**, Takahiro **KONDO**, Makito **HARUTA**, Kiyotaka **SASAGAWA**, Jun **OHTA***

Objective: Although it is easy to obtain sub-retinal information using near-infrared (NIR) fundus imaging, it is difficult to increase the resolution because it uses a long wavelength and is easily influenced by scattering in retinal tissues. However, more diagnostic information can be obtained by colorizing 3-band monochrome NIR images. The goal of this study was to provide a high-quality infrared color fundus image that could be used even for personal healthcare.

Methods: We developed a prototype NIR color fundus camera, which consists of an ophthalmic lens, a co-axial broadband NIR illumination source, and a 6-band visible (3 bands) to NIR (3 bands) camera. The prototype camera can acquire continuous or video images. Image processing techniques such as edge detection, tracking, stabilization, and averaging were applied to the acquired video images to obtain low-noise averaged fundus images.

Results: Fundus images could be acquired by an individual without assistance from a doctor or technician. We reduced the noise in our fundus images by averaging multiple images through image tracking techniques to compensate for fixational eye movements. An NIR image colorized from 3-band monochrome NIR images seemed to be a clearer choroidal image than that obtained using visible illumination.

Conclusions: Our NIR color fundus camera makes it possible for a person to obtain a fundus image without using a mydriatic agent.

Because NIR illumination is not dazzling, a long period of image acquisition can easily be realized. Low-noise NIR color fundus images can be obtained using image tracking and averaging techniques.

Keywords: Near-infrared, Fundus camera, multispectral imaging

---

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Validation of results of OCT Macula categorisation by Artificial Intelligence (AI) algorithm compared to specialist labelling

First Author: Thirumalesh ***M B***
Co-Author(s): Rekha ***SHARMA****, Anand* ***BABU****, Jaiprasad* ***RAMPURE***

Objective: To evaluate the accuracy of AI compared to specialists Reporting. Automated binarisation of OCT scans into normal and abnormal is the initial step in disease detection.
Methods: Retrospective study of anonymised OCT scans for the study period January to july 2018 were independently evaluated.
Results: Analysed dataset were 2872 images out of 3130 scans,258 being non congruent(no consensus) and arbitrated by the principal investigator(PI). The overall F1 scaore was 0.95 in 1408 images labelled normal (positive predictive value (PPV) 0.98,sensitivity (sen) 0.91,specificity (spe) 0.92. and also in 1464 images labelled abnormal PPV 0.92. sens0.98, spe0.98. Receiver operating characteristic ROC shows area under curve of 0.99 for each category.95% confidence interval for abnormal scans was 0.91+/-0.015 and for normal scans was 0.90+/-0.007 and of normal was 0.98+/-0.009. Other conditions and non-gradable categories were not evaluated. interobserver variability by fleiss kappa between two annotators and model had weighted average of 0.88. surveyed metrics and had a p-value<0.05.
Conclusions: the outcome predictions by AI algorithm stand comparable to retina specialist grading. detection of retinal specific gross pathologies for high level referral in a screening pipeline can be done in a seamless and precise manner.

Keywords: Artificial intelligence, OCT, Retina

TELEMEDICINE

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Telemedicine Screening of the Prevalence of Diabetic Retinopathy among Type 2 Diabetic Filipinos in the Community

First Author: Jessica ***DAZA-ROBES***
Co-Author(s): Maria Victoria ***RONDARIS***

Objective: This study tested the feasibility of telemedicine screening for diabetic retinopathy in the community setting and determined the prevalence of diabetic retinopathy among Filipino type 2 diabetic patients in the community.
Methods: This a cross-sectional study of diabetic patients being seen in 6 community urban health centers in the Philippines. Fundus photographs were taken and were uploaded in an online cloud storage and were sent to a tertiary hospital for reading. Quality of fundus photographs were graded and reading was done by a retina specialist. Reading of fundus photographs and patient recommendations were sent back to the health center to be distributed to patients.
Results: A total of 387 eyes were screened. A total of 347 eyes (92.5%) had gradable quality fundus photographs having grade 3 quality and above, wherein all emergent findings could be excluded. A total of 194 patients were screened, 25% (49 patients) had some form of diabetic retinopathy.
Conclusions: Present study showed that diabetic retinopathy is a common a common occurrence in diabetic patients in the community. Telemedicine screening also proved to be an effective means of monitoring presence of diabetic retinopathy in diabetics in low income population. This model can be replicated in other community health centers in order to detect diabetic retinopathy early and to determine which patients need referral to eye centers for treatment to avoid diabetic blindness.

Keywords: telemedicine, diabetic retinopathy screening, public health, community health

---

TELE-OPHTHALMOLOGY

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Addressing barriers to ophthalmic services in rural Western Australia: an audit of an outreach ophthalmology and tele-ophthalmology service

First Author: Angus ***TURNER***
Co-Author(s): Matthew LEE, Vaibhav SHAH

Objective: Lions Outback Vision provides visiting ophthalmology services in rural Western Australia (WA). A tele-ophthalmology initiative has enabled specialists to provide care over a large region. A clinical audit was performed of

our service.
Methods: The retrospective, observational audit examined data from 2017 over seven regional public services. Outcomes included cataract surgery wait times, surgical complications, pre- versus post-operative visual acuities, percentage of Indigenous patients and distribution of ocular co-morbidities.
Results: 315 patients (median age 65.2±11.1 years) underwent 366 cataract surgeries. Half the patients (49.8% (n=157) were Indigenous, had longer waiting times and were more likely to have diabetic retinopathy (DR) (P<0.001).

DR was the most prevalent ocular co-morbidity (15.8%, n=58), of which 55.2% (n=32) had macular oedema. Other co-morbidities included previous ocular trauma (6%, n=23), glaucoma/ocular hypertension (5.2%, n=19), and age-related macular degeneration (3%, n=11).

Median LogMAR [IQR] pre-operative best measured visual acuity (BMVA) was 0.50 [0.3-2.0] and 0.30 [0.2-0.6] for Indigenous and non-Indigenous patients respectively. Post-operatively, there was a significant median improvement in BMVA of 0.3 [0.1-0.6] LogMAR (P<0.001). There were no cases of endophthalmitis or 'dropped nucleus'.

Median time between referral and cataract surgery was 163 [96-259] days. One fifth of cases (19.1%) had surgery booked via telehealth. Wait times were significantly different between telehealth and non-telehealth groups: 111[63-165] median days versus 201[121-292] days (P<0.001) respectively.
Conclusions: Our outreach service, where tele-ophthalmology plays a significant role by improving access to surgery through shortening wait times, provided effective and safe vision-restoring surgery to rural and Indigenous communities in WA.

Keywords: tele-ophthalmology, Indigenous, Aboriginal, cataract surgery, diabetic retinopathy

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Inter-grader variability in Diabetic Retinopathy

First Author: Bhavana ***SOSALE***
*Co-Author(s): Srikanth **NARAYANA**, Sahana GV **GOWDA**, Hemanth **MURTHY**, Muralidhar **NAVEENAM***

Objective: Inter-grader variability can result in an unreliable diagnosis of diabetic retinopathy (DR). Adjudication of discordant diagnosis (either by consensus or use of a majority diagnosis) is practiced to reduce variability. This study aimed to evaluate the inter-grader variability: among retina specialists, and between the Medios offline (artificial intelligence) AI solution and retina specialists in the diagnosis of DR.
Methods: Non-mydriatic retinal images were captured from 950 individuals with diabetes during routine hospital visits at Diacon Hospital, Bangalore, India. Two images [posterior pole (macula centered), nasal field] were captured per eye using the Remidio Non-mydriatic Fundus-on-phone (NM FOP) camera. These were graded individually by 5 retinal specialists as per the International Clinical Diabetic Retinopathy Disease Severity Scale. The kappa between the ophthalmologists was measured. The images were also run offline on the Medios AI algorithm and the diagnosis of the AI recorded. The kappa between the AI and the majority diagnosis among the ophthalmologists was measured.
Results: The kappa for DR grading amongst the ophthalmologists was 0.56 [no DR=0.6, mild (NPDR) non-proliferative DR=0.13, moderate NPDR=0.63 and severe NPDR= 0.32 and (PDR) Proliferative DR=0.79] and for diabetic macular edema (DME) was 0.46 (no DME=0.61, mild DME=0.21, moderate DME=0.4 and severe DME=0.36). The kappa between the Medios AI and the majority diagnosis was found to be 0.81.
Conclusions: Precision among ophthalmologists was weak to moderate. Precision between the Medios AI and the majority image diagnosis was strong. AI algorithms may be a possible solution to reducing inter-grader variability in coming years.

Keywords: diabetic retinopathy, artificial intelligence, inter-grader variability

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Trash to Treasure: Promoting Eye Health with Discarded Smartphones

First Author: Holden **KIM**
*Co-Author(s): Seung **KIM**, Kyung Mo **YANG**, Sangchul **YOON***

Objective: Collection and evaluation of high-quality retinal image is a key to prevent blindness causing eye diseases. However, it is difficult to provide such services in resource limited environment due to the high cost of diagnostic equipment and shortage of eye health professionals. We developed a smartphone-based ophthalmoscope, EYELIKE™, and explored its potential to tackle the

challenges.
Methods: EYELIKE™ is a portable, easy to use, digital ophthalmoscope at an affordable price range. It functions with smartphones, which are re-worked through Samsung Electronics' 'Galaxy Upcycling Program.' The program is designed to collect the company's used smartphones, which otherwise were discarded causing environmental problems, and transform them to serve other socially valuable purposes: in this case, promotion of eye health. Fifteen EYELIKE™ ophthalmoscopes were introduced and operated by non-ophthalmic personnel at the health centers in Thai Nguyen Province of Vietnam. Ocular images collected were evaluated for abnormalities by ophthalmologists at the Central Hospital.
Results: Five thousand community people were screened with EYELIKE™ Digital Ophthalmoscope, and high-quality ocular images with FOV of 45° and resolution of 1778×2371 pixels demonstrating variety of diseases were collected. The diagnoses matched perfectly with traditional examination in 82% of eyes and average sensitivity and specificity was 92% and 78% respectively.
Conclusions: We found that EYELIKE™ Digital Ophthalmoscope yields fundus image with good enough quality when taken by non-ophthalmic personnel in rural areas of Vietnam owing to the user-friendly interface and a short learning curve. The utilization of device demonstrates promising results to increase proper retinal disease screening in resource limited condition.

Keywords: EYELIKE, Upcycling. mobile health, smartphone ophthalmic imaging, teleophthalmology, triage

Sept 22, 2019 (Sunday), 16:30 – 18:00
Venue: Rajendra Hall 7 & 8

Validation of retinal image grading results by a trained non-ophthalmologist grader for detecting diabetic retinopathy in southern India

*First Author: Sanil **JOSEPH***
*Co-Author(s): Kim **RAMASAMY**, Renu **RAJAN***

Objective: To validate the fundus image grading results by a trained non-ophthalmologist grader for detecting diabetic retinopathy with that of an ophthalmologists
Methods: A prospective study including 2002 non-mydriatic fundus images from 1001 patients aged 40 years or older. Using the Aravind Diabetic Retinopathy Evaluation Software (ADRES) images were graded by both a trained non-ophthalmologist grader (grader 1) and an ophthalmologist (grader 2). Inter-rater agreement was estimated by calculating Cohen's Kappa Coefficient (K) for each grader with the grading results by an independent retina specialist who performed dilated indirect ophthalmoscopy for every study participant.
Results: Of the 2002 images graded, 626 (62.5%) images of the right eye and 630 (62.93%) images of the left eye had similar grading from both the graders. Grader 1 had *fair* level of agreement with the findings of the retina specialists in both right eye (K=0.3977) and left eye (K=0.3836). Grader 2 had *moderate* level of agreement in the right eye (K=0.4257) and *fair* level of agreement in the left eye (K=0.3879). Both the comparisons were found to have high levels of statistical significance ($p<0.0001$). The percentage of 'No DR' was high for both grader 1 (57.4%) and grader 2 (48.5). The proportion of 'non-gradable' images were more for grader 1 (4.7%) than grader 2 (1.8).
Conclusions: Our results demonstrates that the grading done by a trained-non ophthalmologist is as good as that by an ophthalmologist. Adopting this model will make DR diagnosis process much efficient thereby enhancing effectiveness of tele-retinal screening.

Keywords: Tele-ophthalmology, Diabetic Retinopathy Screening, Non-ophthalmologist image grader, India

E-POSTERS

ARTIFICIAL INTELLIGENCE

Acceptability of Artificial Intelligence-Based Fundus Screening Amongst General Population

First Author: Divyansh ***MISHRA***
Co-Author(s): Mahesh ***SHANMUGAM****, Payal* ***SHAH****, Rajesh* ***R.****, Hari* ***PRASAD***

Objective: 1.To assess awareness and acceptability of artificial intelligence(AI) based fundus screening amongst general population attending eye camps and tertiary eye care centres.
2.To assess ability of AI based algorithm to identify abnormal fundus (posterior pole).
Methods: Patients visiting hospital for general eye check-up and diabetic retinopathy screening and those attending eye camps were included. A 5-point questionnaire was given to all patients. Undilated and dilated fundus photographs were captured using fundus on phone camera integrated with an AI platform (developed by Lebencare Technologies) which would give immediate response of normal versus abnormal fundus. Patients were then examined by a retina specialist. Time taken for image capture and AI result versus that for clinical examination were recorded.
Results: Awareness and wilfulness of AI based eye screening was calculated. Acceptability of AI based screening versus ophthalmologist based screening was assessed. The most common reason for AI based screening acceptance was noted to be distance, time and cost saved; reason in favour of visiting doctor was human touch and emotional support. Sensitivity and specificity of AI algorithm to identify abnormal fundus was calculated and found to be >86% and >82% respectively. AI based screening took lesser time compared to retina specialist based screening.
Conclusions: Although awareness of AI based fundus screening is still evolving, once its accuracy is improved and availability made popular, this can become a great tool for screening of retinal disorders.
Keywords: Acceptability of Artificial intelligence, fundus screening

Accuracy of a Deep Learning System for the Detection of Myopic Maculopathy on the Basis of Color Fundus Photographs

First Author: Ruilin ***XIONG***

Co-Author(s): Zhixi ***LI****, Guankai* ***PENG****, Chi* ***LIU****, Mingguang* ***HE***

Objective To assess the accuracy of an artificial intelligence-based, deep learning algorithm (DLA) for the detection of myopic maculopathy based on color fundus photographs.
Methods A total of 9,097 color fundus photographs acquired from an online crowdsourcing platform (LabelMe, Guangzhou, China; http://www.labelme.org), which contains more than 200,000 color fundus photographs collected from 36 various clinical settings in China, were used to develop and validate the DLA, of which the goal was to automated classify myopic maculopathy. These retinal images were graded by 21 experienced ophthalmologists according to International Photographic Classification and Grading System scheme, defining myopic maculopathy as diffuse chorioretinal atrophy, patchy chorioretinal atrophy, macular atrophy, lacquer crack, Fuch's spot and/or choroidal neovascularization. The reference standard was made only when three consistent grading outcomes were achieved. After image preprocessing, 7,097 images were randomly selected as training dataset while the rest 2,000 images were used as validation dataset to evaluate its performance. The sensitivity, specificity, accuracy and area under the receiver operating curve (AUC) were calculated.
Results Among the 9,097 color fundus photographs, 857 and 249 photographs were graded as myopic maculopathy in the training and validation dataset, respectively. In the validation dataset, the AUC, accuracy, sensitivity and specificity of this deep learning system were 0.970, 94.7%, 87.6% and 95.7% for myopic maculopathy, respectively.
Conclusions This deep learning system can identify myopic maculopathy with satisfactory sensitivity and specificity, suggesting an effective method of pathologic myopia screening.

Keywords Myopia; Myopic Maculopathy; Artificial Intelligence; Deep Learning; Fundus Photograph

An Artificial Intelligent Platform for Live Cell Identification and the Detection of Cross-Contamination

First Author: Ruixin ***WANG***

Co-Author(s): Dongni ***WANG****, Meimei* ***DONGYE****, Xiayin* ***ZHANG,*** *Haotian* ***LIN***

Objective: About 30% of cell lines have been cellular cross-contaminated and misidentification. Cell morphology under the microscope was observed routinely, and further DNA sequencing analysis was performed periodically to verify cell line identity, but the sequencing analysis was costly, time-consuming, and labor intensive. The purpose of this study was to construct a novel artificial intelligence technology for "cell face" recognition, in which can predict DNA-level identification labels only using cell images.
Methods: Seven commonly used cell lines were cultured and co-cultured in pairs (totally 8 categories) to simulate the situation of pure and cross-contaminated cells. The microscopy images were obtained and labeled of cell types by the result of short tandem repeat profiling. About 2 million patch images were used for model training and testing. AlexNet was used to demonstrate the effectiveness of convolutional neural network (CNN) in cell classification. To further improve the feasibility of detecting cross-contamination, the bilinear network for fine-grained identification was constructed. The specificity, sensitivity, and accuracy of the model were tested separately by external validation. Finally, the cell semantic segmentation was conducted by DialedNet.
Results: The BCNN achieved 99.5% accuracy in identifying seven pure cell lines and 86.3% accuracy for detecting cross-contamination (mixing two of the seven cell lines). DilatedNet was applied to the semantic segment for analyzing in single-cell level and achieved an accuracy of 98.2%.
Conclusions: The platform proposed in this study has the ability to recognize small differences in cell morphology, and achieved high classification accuracy.

Keywords: Cell authentication, Biomedical optical imaging, Image classification, Neural networks

Automated Classification System of Retinal Arteriosclerosis Based on Fundus Photographs

First Author: Yixiong ***YUAN***
Co-Author(s): Zhixi ***LI****, Guankai* ***PENG****, Wei* ***MENG****, Mingguang* ***HE***

Objective: Retinal arteriosclerosis can manifest the severity of hypertensive retinopathy which is predictive of risk for cerebrovascular disease. We aimed to develop and validate a deep learning algorithm (DLA) for the automated detection of significant retinal arteriosclerosis.
Methods: All images included in this study were non-stereoscopic and retrospectively collected from LabelMe dataset. We recruited 21 trained ophthalmologists to classify the photographs. Significant retinal arteriosclerosis was defined as simply artery to vein ratio (AVR) <1/2, or AVR<1/2 with arteriovenous nicking, or AVR<1/2 with opaque artery wall. Reference standard was made until 3 graders achieved agreement. Deep learning was used to develop the automated detection system based on a total of 44815 images. The main outcomes of this study were the area under the receiver operating curve (AUC) , accuracy, sensitivity and specificity, which were generated based on the reference standard.
Results: A total of 7334 images were used in the validation dataset, containing 7061 negative images and 273 positive ones. The DLA successfully selected 112 images from the positive ones by manual grading and 6943 images from the negative ones. The AUC, accuracy, sensitivity and specificity were 0.929, 96.2%, 41.0% and 98.3% respectively.
Conclusions: The automated detection of significant retinal arteriosclerosis with DLA has an outstanding AUC, indicating the high efficacy of this algorithm. The high level of specificity confers the algorithm to had low possibility to misclassify healthy subjects as significant retinal arteriosclerosis. Further research is needed to elevate the sensitivity to make this DLA much more powerful in diagnosis.

Keywords: retinal arteriosclerosis; deep learning algorithm; fundus photographs

Automated Grading of Age-Related Macular Degeneration on Color Fundus Images Using Deep Convolutional Neural Networks

First Author: Chimei ***LIAO***
Co-Author(s): Zhixi ***LI****, Chi* ***LIU****, Mingguang* ***HE***

Objective: To assess the performance of a deep learning algorithm for classifying age-related macular degeneration (AMD) based on color fundus photographs.
Methods: This study recruited 21 trained ophthalmologists to classify the photographs. The fundus photographs were classified into 4 categories: absent, early of intermediate AMD, late dry stage and late wet stage. The reference standard was made until 3 graders achieved agreement. A total of 31147 fundus photographs were used for the development and validation of the deep learning algorithm and this algorithm could detect the above described 4-level categories of AMD. A separate validation dataset of 3119 fully gradable fundus photographs was used to assess the performance of this algorithm. The

area under receiver operator characteristic curve (AUC) with sensitivity and specificity was applied to evaluate the efficacy of the deep learning algorithm for detecting AMD.
Results: In the validation dataset, the overall accuracy was 96.7% and the Cohen's kappa value was 0.89. For each AMD categories, this deep learning system achieved an AUC of 0.987 with sensitivity of 98.2% and specificity of 90.0% for detecting the absence of AMD, an AUC of 0.989 with sensitivity of 83.7% and specificity of 97.4% for early or intermediate AMD, an AUC of 0.995 with sensitivity of 88.9% and specificity of 96.7% for late dry stage and an AUC of 1.000 with sensitivity of 92.4% and specificity of 97.4% for late wet stage.
Conclusions: This deep learning system can detect AMD stage with high sensitivity and specificity.

Keywords: Deep Convolutional Neural Networks, Age-related Macular Degeneration, Artificial intelligence

Detecting Other Eye Conditions with Artificial Intelligence in Singapore's Diabetic Retinopathy Screening Programme

*First Author: Jinyi **HO***
*Co-Author(s): Haslina **HAMZAH**, Raudhah **MOHAMED**, Hanim **RAUDHAH**, Kelvin **TEO**, Daniel **TING**, Tien Yin **WONG**, Gavin **TAN***

Objective: Traditionally, diabetic retinopathy (DR) screening programmes, primarily focus on detection of DR. In Singapore, we do opportunistic screening for other ocular conditions by trained human readers. A standardized protocol was used to detect disc swelling, retinal detachment etc. SELENA+ (Singapore Eye Lesion Analyzer +), our artificial intelligence (AI) system that uses deep learning to detect diabetic retinopathy, glaucoma and age-related macular degeneration on fundus photos. We aim to test SELENA+'s accuracy in detection of eye diseases other than DR.
Methods: We conducted a prospective trial of 13,145 patients for 18 weeks using images acquired from our screening programme. 52,580 retinal fundus images were processed real time using SELENA+, and concurrently reported by readers. SELENA+ output was a numerical score for each image. Using a calibrated threshold of 0.7, cases with higher scores were classified as a referable outcome, while those with lower scores were categorized as non-referable. We used SELENA+'s outcome to compare against reader's referral outcome.
Results: 225 patients (1.7%) were graded to have other ocular eye conditions by readers. Of these 225 patients, 153(68%) patients were detected by SELENA+ to be referable. In accordance to our referral guidelines, 173 (1.7%) patients had urgent condition that required referral to an eye specialist within a week and SELENA+ was able to identify 106 (61%) of these patients as requiring specialist referral.
Conclusions: SELENA can detect conditions, other than DR, when compared to human readers. With further training and validation, SELENA+ could potentially widen its use for early detection of other eye diseases.

Keywords: diabetic retinopathy (DR), artificial intelligence (AI) system,deep learning

Efficacy of a Deep Learning System for Detecting Choroidal Neovascularization Based on Optical Tomography Images

*First Author: Zhuo **ZHU***
*Co-Author(s): Zhixi **LI**, Guankai **PENG**, Chi **LIU**, Mingguang **HE***

Objective: To assess the performance of a deep learning algorithm for detecting choroidal neovascularization (CNV) based on optical coherence tomography (OCT) images.
Methods: A deep learning algorithm for automated classification of CNV were developed and validated on OCT images (Spectralis OCT, Heidelberg Engineering, Germany). The presence of CNV was diagnosed based on the medical record databases. The area under receiver operator characteristic curve (AUC) with sensitivity and specificity was applied to evaluate the efficacy of the deep learning algorithm detecting CNV.
Results: A total of 35,916 OCT images were used in the development and validation of this algorithm (train dataset ,25313 images; validation dataset 4491 images). In the separate validation dataset, containing 3165 images had CNV and 1326 normal ones. This deep learning system achieved an AUC of 1.00 with sensitivity of 99.9% and specificity of 100.0%.
Conclusions: This deep learning system can detect CNV with high sensitivity and specificity, indicating a potential effective way to detect CNV automatedly in the clinical or screening settings.

Keywords: Artificial intelligence, deep learning, choroidal neovascularization

Estimation of Blood Pressure Through Fundus Photograph-Based Deep Learning Model in a Chinese Population

*First Author: Wei **WANG***
*Co-Author(s): Yu **JIANG**, Chi **LIU**, Mingguang **HE***

Objective: To develop a deep learning model to estimate the blood pressure based on fundus photography.
Methods: This study retrospectively included 15544 individuals from population-based studies in Southern China. Participants underwent comprehensive ocular examinations, physical examinations, anthropometry, and laboratory assessment, including fundus photography and blood pressure measurements. Of the total set, 12435 fundus images were used for training and development of the deep learning model, another two independent set were used for evaluating the model performance, including 1551 images used as validation set and 1558 images used as test set. Only macular-centered retinal photos of sufficient quality were included. The mean absolute error (MAE) was used to evaluate the performance of the deep learning model.
Results: In the validation dataset, the overall MAE between model-predicted and actual measurements were 13.54 mmHg for systolic blood pressure and 8.84 mmHg for diastolic blood pressure, respectively. In the test dataset, the overall MAE between the 2 measurements were 14.51 mmHg for systolic blood pressure and 9.70 mmHg for diastolic blood pressure, respectively. These results indicate substantial agreement between the 2 measurements with slight overestimation by the deep learning models.
Conclusions: With the proposed deep learning model, the systolic and diastolic blood pressure can be accurately calculated from fundus photography independently in a large Chinese population. It indicates the potential value of retinal images for predicting systemic diseases.

Keywords: retinal imaging; deep learning; blood pressure

BIG DATA ANALYTICS

Artificial Intelligence Deciphers Codes for Color and Odor Perceptions Based on Large-Scale Chemoinformatic Data

First Author: Xiayin ***ZHANG***
Co-Author(s): Kai ***ZHANG****, Duoru* ***LIN****, Ruixin* ***WANG****, Haotian* ***LIN***

Objective: Color vision is the ability to detect, distinguish, and analyze the wavelength distributions of light independent of the total intensity. It mediates the interaction between an organism and its environment in multiple important aspects, including mate choice, camouflage, and speciation. However, the physicochemical basis of color coding has not been explored completely, and how color perception is integrated with other sensory input, typically odor, is unclear.
Methods: We developed an artificial intelligence (AI) platform to train algorithms for predicting color and odor based on large-scale physicochemical features of 1267 and 598 structurally diverse molecules, respectively. Genetic algorithms for feature selection were applied to determine key physicochemical features. The colors and odors of 90 molecules were collected, and two groups of chi-square tests were carried out to investigate the correlation between color and odor. The interactional physicochemical features between color and odor decisions were assessed by the Pearson correlation coefficients in the complex network.
Results: The predictive accuracies using the random forest and deep belief network for the prediction of color were 100.0% ± 0.0% and 100.0% ± 0.0% (mean ± SD), respectively. A positive correlation between the color coding and odor coding properties of the molecules was predicted.
Conclusions: Our random forest model and DBN accurately predicted the colors and odors of structurally diverse molecules. These findings extend our understanding of the molecular and structural basis of color vision and reveal the interrelationship between color and odor perceptions in nature.

Keywords: color perception; structure-color relationships; random forest; deep belief network

CATARACT

A Study on Incidence of Dry Eye Following Small Incision Cataract Surgery

First Author: Keerthi Sri ***A. S.***
Co-Author(s): Kuppam ***PESIMSR***

Objective: To find out the incidence of dry eye following small incision cataract surgery.
Methods: A standard operating procedure of small incision cataract surgery was done on 60 patients in a period of 3 months, under local anaesthesia. All the patients received uniform medication before, during and after surgery for every individual ocular surface disease index (OSDI) score. Schirmer's test 1, tear film break up time (TBUT), tear meniscus height was done and the severity of dry eye was assessed based on dews dry eye severity grading preoperatively and 2 weeks following surgery.
Results: The incidence of dry eye was as follows: mild dry eye – 20%; moderate dry eye –

6%; severe dry eye – 4%.
Conclusions: Cataract surgery is capable of triggering dry eye symptoms and affecting dry eye test values. Dry eye after cataract surgery is mainly because of tear film instability.

Keywords: Dry eye, Small incision cataract surgery

A Study on Occurrence of Post-Operative Complications Following Small Incision Cataract Surgery

First Author: Keerthi Sri ***A. S.***
Co-Author(s): Kuppam ***PESIMSR***

Objective: To find out the occurrence of post-operative complications following small incision cataract surgery.
Methods: A standard operating procedure of small incision cataract surgery was done on 126 patients in a period of 3 months, under local anaesthesia. All the patients received uniform medication before, during and after surgery. For every individual patient post-operative complications was estimated on the 1st post-operative day.
Results: The occurrence of post-operative complications was s follows: corneal edema – 19%; striate keratopathy – 13%; Descemet's membrane folds – 7%; Descemet's membrane detachment – 1%; anterior chamber reaction – 13%; hypopyon – 2%; hyphaema – 2%; Iris Bombe – 2%; iridodialysis – 1%; posterior capsular rent – 2%.
Conclusions: Small incision cataract surgery is a safe surgery. The surgeon has to be extra diligent in tunnel construction as the tunnel size is large. An excellent self-sealing incision is vital. The prolapse of nucleus into the anterior chamber and its delivery through tunnel involve manipulations very close to the iris and the cornea. The surgeon has to be extra careful with these structures, as post-operative corneal edema, striate keratopathy and anterior chamber reaction are very common. More attention needs to be paid to cortical wash and capsular polishing, as PCO may be the only factor for suboptimal visual acuity in the future.

Keywords: Post-operative complications, Small incision cataract surgery

DEEP LEARNING

An Automated Aided Diagnosis System for Detection of Diabetes Mellitus Based on Color Fundus Photographs

First Author: Yu ***JIANG****,*
Co-Author(s): Chi ***LIU****, Guankai* ***PENG****, Mingguang* ***HE***

Objective: The goal of this study was to describe the development of an artificial intelligence–based, deep learning algorithm (DLA) for the detection of diabetes mellitus (DM).
Methods: The DLA was tested by using a set of 191,882 retinal images acquired from the program named Screening and Prevention of Health Express Diabetic Retinopathy since 2014 in China population. There were 7,201 images classified as ungradable (not fundus images or poor quality). Patients fundus photographs were randomly assigned into one of three sets: a training set（70%，n=129,277）, validation set (20%，n=36,936）and a test set (10%, n=18,468). All images were non-stereoscopic and retrospectively collected. Gold standard diagnosis (DM: yes or not) was assigned patients individual data from hospital and personal questionnaire.
Results: In training data set, the test accuracy, sensitivity and specificity for detection of DM were 0.879, 92.56% and 82.38% respectively. Among false-positive cases, 79% were due to other macular pathologies or microangiopathy.
Conclusions: This artificial intelligence–based DLA can be used with high accuracy in the detection of DM in color fundus photographs. This technology offers potential to increase the efficiency and accessibility of DM screening programs.

Keywords Deep learning algorithm, Diabetes mellitus (DM), Color fundus photographs

Automated Detection of Diabetic Macular Edema in Optical Coherence Tomography Using Deep Learning

First Author: Zhixi ***LI***
Co-Author(s): Guankai ***PENG****, Wei* ***MENG****, Mingguang* ***HE***

Objective: To develop and validate a fully automated method to classify diabetic macular edema (DME) in optical coherence tomography (OCT) images.
Methods: The clinical dataset of DME was consisted of 36 609 OCT (Spectralis OCT, Heidelberg Engineering, Germany) scans. The

diagnosis of DME was based on the clinical records. A deep learning method of automatically detecting DME was developed. The performance of the algorithm was evaluated against the clinical diagnosis made by ophthalmologists.
Results: This algorithm was developed on 28 242 OCT images (DME 8 367, normal 19 875). In the validation dataset (n=4 461), 3 139 images were normal and 1 322 had DME. The area under the curve (AUC), accuracy, sensitivity and specificity of this automated algorithm were 0.998, 98.5%, 96.8% and 99.2%, respectively.
Conclusions: Deep learning in retinal diseases analysis achieves excellent accuracy for the detection of DME using OCT devices when compared with the clinical diagnosis. Further studies to evaluate this algorithm in different settings and races were warranted.

Keywords Deep learning, diabetic macular edema,optical coherence tomography

GLAUCOMA

Role of Remote Monitoring of Diurnal Variation in the Diagnosis and Follow-Up of Open Angle Glaucoma in a Tertiary Health Care Centre

First Author: Mayuresh ***NAIK***

Objective: To elucidate role of remote monitoring of diurnal variation in diagnosis and follow-up of open angle glaucoma.
Methods: 500 age and sex-matched patients from outreach-centre were selected for remote monitoring of diurnal variation. They were randomly divided into two groups of 250 :
Group A : Underwent diurnal variation using Schiotz tonometer by skilled clinical assistant and cases with diurnal variation ⩾ 6mmHg or maximal intraocular pressure reading >21mmHg were referred to our tertiary health care centre for glaucoma work-up
Group B : All 250 patients were brought to our tertiary health care centre for glaucoma work-up.

After diagnosis and after 3 weeks of initiation of anti-glaucoma medications , total number of glaucoma cases in both groups were combined and again randomly divided into two equal groups C and D.
Group C : Underwent diurnal variation using Schiotz tonometer by skilled clinical assistant and cases with diurnal variation ⩾ 6mmHg or maximal intraocular pressure reading above target pressure were referred to our tertiary health care centre for further assesment
Group D : All patients were brought to our tertiary health care centre for glaucoma follow-up.
Results: There was no statistical significance (p=0.78) between the two groups A and B regarding the number of diagnosed cases of glaucoma.

There was no statistical significance (p=0.34) between the two groups C and D regarding the number of cases of glaucoma on follow-up.
Conclusions: Remote monitoring of diurnal variation is very effective method in the diagnosis & follow-up of open angle glaucoma in out-reach centres

Keywords diurnal variation; glaucoma; IOP

RETINA & VITREOUS

A Case Report on Idiopathic Retinal Vasculitis, Aneurysms and Neuroretinitis (IRVAN) Syndrome

First Author: First Author: Keerthi Sri ***A. S.***
Co-Author(s): Kuppam ***PESIMSR***

Objective: To see the visual outcome and disease progression with early intervention with panretinal photocoagulation in a case of idiopathic retinal vasculitis, aneurysms, neuroretinitis (IRVAN) Syndrome
Methods: IRVAN Syndrome includes peculiar vascular abnormalities in the form of multiple aneurysmal dilatations seen along retinal arterioles and optic nerve-head arterioles, which are best appreciated on fundus fluorescein angiography. The devastation vision threatening outcomes of this syndrome include exudative retinopathy and extensive peripheral retinal nonperfusion areas, which can eventually lead to neovascularization. Early intervention with panretinal photocoagulation was done in a case of IRVAN Syndrome and the visual outcome and disease progression was observed.
Results: Early intervention with panretinal photocoagulation in a case of IRVAN Syndrome showed a dramatic improvement in the vision and a dramatic reduction in the disease progression.

Conclusions Early intervention in IRVAN Syndrome in the form of panretinal photocoagulation without waiting for the neovascularization to develop is important, as the nature of the disease is more aggressive than other ischemic retinopathies.

Keywords IRVAN Syndrome, Pantretinal photocoagulation

TELE-OPHTHALMOLOGY

Offline Artificial Intelligence (AI) Assisted Detection of Referable Diabetic Retinopathy

*First Author: Sivaranjani **S***
*Co-Author(s): Manavi D. **SINDAL**, Kurian **JOSS**, Anand **SIVARAMAN***

Objective: To assess the effectiveness of an offline artificial intelligence (AI) analysis of images obtained by a modern smartphone based optical device (Remidio FOPNM-10) in detecting referable diabetic retinopathy (DR).
Methods: OPD based screening for diabetic retinopathy was done using a Remidio non mydriatic fundus camera attached to a phone with offline AI. All patients were evaluated by a trained vitreoretinal surgeon, and fundus images taken were run through the AI to detect referable DR. The sensitivity and specificity of the offline AI is evaluated.
Results: Out of 176 (100%) eyes screened, AI detected diabetic retinopathy changes in 29 eyes in which 21(11.93) eyes had DR changes, 1(0.56%) eye had BRVO, 2(1.13%) eyes had CNVM, 1(0.56%) eye had traumatic VH, 2 (1.13%) eyes had PCV and 2 (1.13%) eyes were normal. AI didn't detect DR changes in 4 eyes who had mild NPDR. The sensitivity of AI is 84% and specificity 94.96%.
Conclusions: A smartphone-based device is convenient for imaging the fundus as it is portable, light-weight and easy to use. It can be used in remote areas, non-ophthalmology clinics, outreach camps etc. An offline AI that can detect referable DR, without need to upload images to a server, can greatly ease screening.

Keywords: diabetic retinopathy screening, offline artificial intelligence, fundus camera.

Tackling the Challenges of Internet Bandwidth Connectivity for Teleophthalmology in Rural Locations in India

*First Author: Mukesh **TANEJA***
*Co-Author(s): Shravani **M**, Jagadesh **RAO**, Ashutosh **RICHARIYA**, Jean-Marie **PAREL***

Objective: For the past couple of years we have we have started providing corneal services at our secondary centres located in rural areas. As the visits of cornea specialists to these centres are only periodical, we decided to use robotized teleophthalmic slit lamps for follow up of these patients remotely. However, there was a concern regarding the availability of adequate bandwidth of about 10 mpbs for optimal functioning of these robotized slitlamp.
Methods: We tried various modalities of internet connections at different rural locations. These modalities included dongles of various telecom service providers, fibre optic cable network of Internet Service Providers (ISP), BSNL landline connections and broadband aggregator device. Upload and download speed and Ping time were checked with all the available connections at different locations
Results: The download and upload speed was found to be low for various dongles of the telecom service providers and BSNL landline services and these had long latency and Ping times. However, some Internet Service providers were able to provide good bandwidth with low lag through fibre optic cables for optimal video streaming and remote controlling of Robotic Slitlamps. Commercially available bandwidth aggregator device came across as a useful alternative when a direct cable connection by any ISP was not available.
Conclusions Most of the SIM cards and Dongles are sufficient for tele-ophthalmology services based on transmission of still photographs. However, for the optimal functioning of video based teleophthalmology services, internet connection with direct fibre optic cables or aggregator devices are the preferred modalities for internet connectivity in rural locations

Keywords Robotic Slitlamp, Tele-ophthalmology, Stereoscopic Slitlamp

Tele-Screening and Sterio-Imaging in Diabetic Retinopathy Patients from Remote Distant Communities

*First Author: Tejeswara **DHUPAM***

Objective: The objective is to elaborate the use of Sterio Digital Ophthalmology in making an efficient and collaborative screening and

referring system for patients of remote communities.

Methods: A online Server based 3D software name Secure Diagnostic Imaging is Used and Imaging, Online Screening and Recommendations and referral Patterns are designed. All peripheral Ophthalmology referral centers like ophthalmology clinics, optomertry clinics are involved in taking sterioscopic images of retina of patients with Diabetic Retinopathy. All the images are graded basing on a template giving us a measure of severity of disease for prioritizing the referral to a retina specialist.

Results: One of the most successful innovation in the country with the most cost-effective true supplementation of patient examination referral and recommendations.

Conclusions: There is a role of server-based 3D Digital Imaging Software in Imaging, screening and referring patients in Diabetic Retinopathy Patients.

Keywords Tele-Screening and Sterio-Imaging in Diabetic Retinopathy Patients from remote Distant communities

UVEITIS

A Case of Multiple Infectious Retinochoroiditis in an Immunocompromised Male: A Case Report

First Author: Jessica ***DAZA-ROBES***

Objective: To describe the course of multiple opportunistic ocular infections in an immunocompromised young, Filipino male.

Methods: This is a descriptive case report based on clinical records, laboratory and diagnostic examinations.

Results: This is a rare case of multiple opportunistic ocular infections in a 30-year-old male living with HIV who initially presented with severe headache accompanied by diplopia on the left gaze. Fundus examination showed bilateral optic disc edema and hyperemia with multiple subretinal yellowish lesions and scattered intraretinal hemorrhages. Lumbar puncture and CSF tested positive for Cryptococcal Antigen (CALAS) and Cryptococcus neoformans on india ink. He was managed as a case of cryptococcal meningitis and cryptococcal choroiditis and was started on antifungals. Diplopia was resolved post-treatment but he reported seeing shadowing on his left eye. On re-examination, there was a marked decrease in peripheral chorioretinal lesions, however, he had flame shaped hemorrhages on the vascular arcades with suspicious necrosis. CMV retinitis was considered and he was started on oral valgancyclovir and was later given a total of 5 doses of intravitreal injections of ganciclovir. On follow up after 9 months, there was marked resolution of hemorrhages on both eyes.

Conclusions: Cryptococcal choroiditis is a rare but debilitating complication in immunocompromised patients and combined opportunistic ocular infections in persons living with HIV is a rare but possible occurrence. Early eye screening must be added to the routine examinations in HIV patients even in patients with good visual acuity in order to catch disease early and avoid potential blindness.

Keywords: Immunocompromised, cryptococcal chorioretinitis, cytomegalovirus retinitis

VIDEOS

RETINA & VITREOUS

Management of a Case of Chronic Cyclodialysis Cleft Repair Using Innovative Sewing Machine Technique

First Author: Divyansh ***MISHRA***
Co-Author(s): Mahesh ***SHANMUGAM****, Rajesh* ***R.****, Bindiya* ***DOSHI***

Objective: Management of a case of chronic hypotony with cyclodialysis cleft post-shuttle cork injury, early posterior sub-capsular cataract. A 38-year-old male, IOP 4 mm of Hg even after medical management with topical cycloplegic & systemic steroids. Cycodialysis cleft is confirmed with UBM 4-5 clock hours. B scan showed thickened choroid with peripheral choroidal detachment. OCT showed multiple choroidal folds with disc edema.
Methods: Cyclodialysis cleft repair done using sewing needle technique. Details in the video
Results: Post-operative one month IOP increased to 15 mm of Hg. Post-operative UBM / AS OCT / gonio showed closed cleft. Post-operative B scan showed grossly decreased choroidal thickness with no peripheral choroidal detachment. OCT showed resolved choroidal folds with resolved disc edema.
Conclusions: Innovative sewing needle technique can be utilized for management of chronic cyclodialysis cleft.

Keywords Chronic cyclodialysis clef, sewing machine technique

TELE-OPHTHALMOLOGY

Using Retcam Based Tele-Ophthalmolmic Imaging in Enhancing Retinopathy of Prematurity Screening and Referral and Treatments In Rural Peripheral Ophthalmic

First Author: Tejeswara ***DHUPAM***

Objective: The objective is to evaluate the role of tele-ophthalmic imaging in premature babies for detection of Retinopathy of prematurity in screening, referral and treatment.
Methods: A retcam is used to image the retina of premature babies from peripheral ophthalmic clinics. A trained technician takes images and uploads the images into server-based software for the retina specialist to read online and refer the babies to a base hospital for further treatment. An evaluation of the effectiveness of the screening programme, the quality of referral and the impact of the screening programme can be made over time.
Results Retcam-based tele-ophthalmic screening is an effective way to screen, refer and treat babies at risk of retinopathy of prematurity in remote communities.
Conclusions Retcam-based tele-ophthalmic screening is an effective way to screen, refer and treat babies at risk of retinopathy of prematurity in remote communities.

Keywords: Retcam-based tele-ophthalmic imaging, Retinopathy of Prematurity screening

EXHIBITOR INDEX

1. Alcon Laboratories (INDIA) Pvt Ltd, Chennai
2. Aurolab
3. Carl Zeiss AG
4. C3 Prototypes – Colpen Products Pvt. Ltd.
5. Forus Health Private Limited
6. Google
7. Kaggle
8. Medi-Whale Inc.
9. Mehra Eyetech Private Limited
10. Novartis AG
11. Remedio Innovative Solutions Pvt. Ltd
12. Sunpharma Pharmaceuticals
13. Topcon Healthcare Solutions
14. Verily

AUTHOR INDEX

AUTHOR INDEX

FINANCIAL DISCLOSURE INDEX

A

Krishna ADITHYA
Remidio Innovative Solutions; E

C

Sandipan CHAKROBORTY
Carl Zeiss India, Bangalore Pvt Ltd; E

F

Alexander FREYTAG
Carl Zeiss AG, Jena, Germany; E

K

Dhivakar KANAGARAJ
Carl Zeiss India, Bangalore Pvt Ltd; E

M

Ashish MODI
Carl Zeiss India, Bangalore Pvt Ltd; E

P

Krunalkumar Ramanbhai *PATEL*
Carl Zeiss India, Bangalore Pvt Ltd; E

R

Kavya RAMACHANDRA
Carl Zeiss India, Bangalore Pvt Ltd; E

Divya RAO
Remidio Innovative Solutions; C

V

Florian SAVOY
Medios Technologies; E

Description of Financial Interests:

F *- Through employing institution support from a for-profit company, or competing company, in the form of research funding or research materials or services at no cost, for subject of presentation.*

I *- Investor in a company or competing company, but not a mutual or retirement fund, providing a product, service process or equipment which is the subject of presentation.*

E *- Employee of a company or competing company with a business interest which is the subject of presentation.*

C *- Currently, or within the last three years, been a consultant for a company or competing company with a business interest which is the subject matter of presentation.*

P *- Inventor/developer designated on a patent, patent application, copyright, or trade secret, whether or not presently licensed or commercialized, which is the subject of presentation or could be in competition with the technology described.*

R *- Received gifts in kind, honoraria or travel reimbursement valued at over USD 1000 in the last twelve months from a company or competing company providing a product, service, process or equipment which is the subject or presentation.*

The 5th Asia Pacific Tele-Ophthalmology Society (APTOS) Symposium

KOREA, 2020

2020 APTOS

APTOS
ASIA PACIFIC TELE-OPHTHALMOLOGY SOCIETY

KOS
KOREAN OPHTHALMOLOGICAL SOCIETY

in conjunction with

The 122nd Korean Ophthalmological Society Meeting