# Al for Good Global Summit, May 2018: Idea for Focus Group on Al for Health

- Second AI for Good Global Summit: session on AI for health
- Need for partnership on AI for health, combining expertise in Health (WHO) and ICT (ITU)
- Idea for the Focus Group on AI for Health (FG-AI4H) is born
- ITU in corporation with WHO creates FG-AI4H in July 2018



Opening keynote by DG of WHO (Dr. Tedros)

# ITU/WHO Focus Group on Artificial Intelligence for Health







An ITU Focus Group In collaboration with WHO Funding support by: fondation BOTNAR

### Size of the Internet

Running the Internet, ICT devices including their production, and data centers takes about 11% of the total electricity in 2018

Source: N. Jones, "How to stop data centres from gobbling up the world's electricity," Nature, September 2018

"Nuclear energy now provides about 11% of the world's electricity from about 450 power reactors"

Source: www.world-nuclear.org, 2019



\*Sources: Cisco VNI reports

## Scaling

### Video compression standards

- H.264 (2003) Now: 55%
- H.265 (2013) Now: 7%

### of all bytes on the Internet

Source: Encoding.com 2019 - Global Media Format Report





\*Sources: Cisco VNI reports

### What about AI for Health?



- Artificial Intelligence for Health (AI4H) offers substantial improvements for public and clinical health; e.g.,
  - early detection,
  - diagnosis,
  - risk identification,
  - treatment decision support,
  - self-management,
  - improved outcomes, ...
- How can we achieve world-wide scaling of AI for Health?

### World-wide Scaling: App Repository





Digital health that scales around the world?

What needs to be done to make it work?

### ITU/WHO Focus Group on Artificial Intelligence for Health (FG-AI4H)





World Health Organization

Chair

• Thomas Wiegand, Fraunhofer HHI / TU Berlin, Germany

Vice-Chairs:

- Stephen Ibaraki, ACM, Canada
- Ramesh Krishnamurthy, World Health Organization
- Naomi Lee, The Lancet, United Kingdom
- Sameer Pujari, World Health Organization
- Manjula Singh, ICMR, India
- Shan Xu, CAICT, China

### Stakeholders & Cooperations



- WHO World Health Organization
- ITU International Telecommunication Union
- IANPHI International Association of National Public Health Institutes
- *Regulators (per country or via WHO)*
- IAP InterAcademy Partnership
- Al4Good Al for Good Global Summit
- WHS World Health Summit
- Philanthropic Foundations

# ITU/WHO FG on AI for Health



- FG-AI4H was created in July 2018
- Goal: benchmarking for AI for Health solutions.
- Such a benchmarking is relevant for applications including:
  - regulatory processes for medical devices and other aspects
  - digital epidemiology
  - health delivery system

## Example benchmark: Diagnostic Support for Breast Cancer



- Tumor infiltrating lymphocytes (TILs) are implicated in eliminating tumor cells
- Quantification of TILs relevant for patient prognosis estimation and therapy
- Replace "eye-balling" by pathologist with Machine Learning
- Focus Group: specify process on data generation and evaluate accuracy of Machine Learning method



Source: Hendry, S., Salgado, R., Gevaert, T., Russell, P. A., John, T., Thapa, B., ... & Sanders, M. (2017). Assessing Tumor-Infiltrating Lymphocytes in Solid Tumors: A Practical Review for Pathologists and Proposal for a Standardized Method from the International Immuno-Oncology Biomarkers Working Group Part 2 (...). Advances in anatomic pathology, 24(6), 311-335. Copyright 2017 Wolters Kluwer Health, Inc. All rights reserved.



### Histological slide



# Microscopic diagnostics

# Histopathology: Diagnose diseases, guide therapy decisions



### 350 Mio. diagnostic cases worldwide per year!





# Manual evaluation



### identify & classify cancer!

WHO Classification of Tumours of the Breast

























Estimate Immune cells!

, Charite Ber irce: F. Klauso

### Al-assisted Histopathology





# Annotation of Histopathology Images



Specifications:

- Digitized histological slides in standard staining
- Comprehensive tissue component annotations:

### cancer tissue

multiple subtypes

focus on NST (no-special-type) and invasive-lobular breast cancer

### normal tissue

normal breast gland and duct epithelium connective tissue (fibers, cells) fatty tissue, bone tissue, nerves blood and lymphatic vessels

### immune system

Lymphocytes, plasma cells Granulocytes, monocytes/macrophages

necrotic tissue

artifacts

Background

• Positive and negative annotations

### Annotation of Histopathology Images





### Benchmarking Process





### **Benchmarking Process**



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AI for Health

### Timeline







### More Information: ITU/WHO Focus Group on AI for Health

- Search: use "AI4H" as string
- Website: <a href="https://itu.int/go/fgai4h">https://itu.int/go/fgai4h</a>
- Next meetings:
  - March 2020 Singapore
  - May 2020 Geneva, Switzerland







WG: "Regulatory Considerations"





### Chair

• Naomi Lee, The Lancet, United Kingdom

Vice-Chairs are representatives of:

- Paolo Alcini, EMA, Europe
- Khair ElZarrad, FDA, USA
- Wolfgang Lauer, BfArM, Germany
- Peng Liang, HPMA, China
- Chandrashekar Ranga, CDSCO, India

### Regulatory Impact: SaMD Categories



State of Healthcare	Significance of information provided by SaMD healthcare decision		
situation or condition	Treat or diagnose	Drive clinical management	Inform clinical management
Critical	IV	III	II
Serious	III	II	I
Non-serious	II	I	Ι

	Significance of information provided by software to healthcare decision				
State of Healthcare situation or condition	Treat or diagnose w/no intervention possible	Treat or diagnose w/Override	Treat or diagnose w/Approval	Drive Clinical Management	Inform Clinical Management
Critical	VI	V	IV	III	II
Serious	V	IV	III	II	Ι
Non- serious	IV	III	II	Ι	Ι

### Workshop: Standardized Assessment Framework on AI for Health

- When: 8. & 9. January 2020
- Where: Fraunhofer HHI, Berlin, Germany

Workshop on Artificial Intelligence for Health Standardized Assessment Framework - Handling and Assessment Methods

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Focus Group on Al for autonomous and assisted driving Focus Group on Quantum Information Technology for Networks	Fraunhofer HHI Berlin, Germany, 8-9 Jan 2020 <u>Invitation and details</u> > Programme >	Registration > <u>Nearby hotels</u> >	Area map > Powerpoint template > (for presenters)	
Focus Group on Environmental Efficiency for Artificial Intelligence and other Emerging Technologies Focus Group on Artificial Intelligence for Health	Workshop organizers <ul> <li>Luis Oala (Quality assess</li> <li>Marc Lecoultre (Technical Activities 1. and 2.)</li> </ul>	ment topics, i.e. Activity 3.) infrastructure topics, i.e.	Venue <sup>dignizitadi</sup> Fraunhofer Institute for Telecommunications CINIQ of Fraunhofer HHI Salzufer 6 Entrance Otto-Dibelius-Strasse 10587 Berlin GERMANY	

### Focus Group on "Artificial Intelligence for Health"

English

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中文

Focus Group on Environmental Efficiency for

Artificial Intelligence and other Emerging Technologies

Focus Group on Artificial Intelligence for Health

Focus Group on Vehicular Multimedia

Focus Group on Technologies for Network 2030

Focus Group on Machine Learning for Future Networks including 5G

Focus Group on Application of Distributed Ledger Technology

Focus Group on Digital Currency including Digital Fiat Currency

Focus Group on Data Processing and Management

**Concluded Focus Groups** 



#### FG-AI4H

Automatic Translation:

The ITU-T Focus Group on artificial intelligence for health (AI4H) was established by ITU-T Study Group 16 at its meeting in Ljubljana, Slovenia, 9-20 July 2018. The Focus Group will work in partnership with the World Health Organization (WHO) to establish a standardized assessment framework for the evaluation of AI-based methods for health, diagnosis, triage or treatment decisions. Participation in the FG-AI4H is free of charge and open to all.

The scope and general process of the focus group are described in a commentary in The Lancet and a white paper. The documentation of all previous meetings can be found on the collaboration site (free ITU account needed).

#### Terms of reference >

Parent group > ITU-T Study Group 16

Español Francais Русский

#### Topic areas:

- Dermatology (TG-Derma)
- Falls among the elderly (TG-Falls)

Histopathology (TG-Histo)

Meetings and Focus Group Focus Group Related Events News Videos

Geneva, Switzerland, 29 May -1 June 2019

Breakthrough on artificial intelligence for health @ "Al for Good" Global Summit (29 May) and 5th meeting of FG-Al4H (30 May - 1 June) (Announcement | Logistics)

Please register for both events below.

#### Breakthrough on AI4H (29 May)

- The workshop will be part of the "A.I. for Good" Global Summit 2019.
- Please register here Registration is separate from the FG meeting itself)

#### FG Meeting (30 May - 1 June)

- Register here (see instructions for help)
- Documents for this meeting
- Submit written proposals by e-mail to tsbfgai4h@itu.int before the deadline (22 May 2019 @ 23:59 CEST).
   [Use this template - Please do NOT submit as PDF]
- Remote participation via Zoom







#### FG-AI4H Home

#### All Documents Meeting A Documents Meeting B Documents Meeting C Documents Meeting D Documents Meeting E Documents Meeting F Documents Meeting G Documents Topic Groups Working Groups Management FG-AI4H Secretariat Calendar Pictures

#### FG-AI4H

#### Focus Group on Artificial Intelligence for Health Established: July 2018 - Public web page

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#### Meeting G

- New Delhi, India, 11-15 November 2019
- 11-12 November: 7th ITU/WHO AI4H Workshop - 13-15 November: 7th FG-AI4H meeting

#### Announcement | Registration | Logistics | About New Delhi

- Workshop (Information | Programme)
- Submit written contributions by e-mail to tsbfgai4h@itu.int before the deadline (4 November).
   [Use this template and please do NOT submit as PDF.]
- Travel grant (deadline extended 14 October)

#### »Past Meetings

#### **Document Templates**

• Documents | Liaison Statements

#### Key reference documents

- Terms of reference
- Templates
  - Topic description document: C-105
  - Call for topic group participation: E-004
  - Call for use cases, benchmarking, and data: E-102
- Output documents
  - FG-AI4H Whitepaper

#### Science is what we understand well enough to explain to a computer. Art is everything else we do.

#### FG-AI4H Global Calendar

20		10200/11	VVLDIVLS			I JAION
29	30	1	2	3	4	5
6	7	8	9	10	11	12
		4:00 pm WG-DAIS		TG-Sy	mptom In-	-P
13	14	15 4:00 pm WG-DAIS	16	17	18	19
20	21	22 4:00 pm WG-DAIS	23	24	25	26

Structure of FG-AI4H



Structure of FG-AI4H



# Current Example Health Topic Groups



- 1. Cardiovascular disease risk prediction (TG-Cardio)
- 2. Diagnoses of bacterial infection and anti-microbial resistance (AMR) (TG-Bacteria)
- 3. Dermatology (TG-Derma)
- 4. Falls among the elderly (TG-Falls)
- 5. Histopathology (TG-Histo)
- 6. Malaria detection (TG-Malaria)
- 7. Neuro-cognitive diseases (TG-Cogni)
- 8. Outbreak detection (TG-outbreaks)
- 9. Ophthalmology (TG-Ophthalmo)
- 10. Psychiatry (TG-Psy)
- 11. Radiothereapy (TG-Radiotherapy)
- 12. Snakebite and snake identification (TG-Snake)
- 13. Symptom assessment (TG-Symptom)
- 14. Tuberculosis (TG-TB)
- 15. Volumetric chest computed tomography (TG-DiagnosticCT)

Structure of FG-AI4H



# Output by Working Groups: Documents and Software Tools



- AI4H ethics considerations
- AI4H regulatory considerations
- AI4H requirements specification
- Al software life cycle specification
- Data specification (requirements, acquisition, annotation, training and test, handling, sharing practices)
- Al training best practices specification
- AI4H evaluation specification (evaluation process, technical test specification, technical test metric, clinical validation)
- AI4H scale-up and adoption
- AI4H applications and platforms (Mobile applications, cloud-based AI applications)

## Planned Technical Deliverables





Today's Al Projects



### **Typical assumptions**

- Linear deployment (train once and use)
- Fixed input-output relation (stationarity assumption)



### Al in Real Life



Data distribution is changing (e.g. influencing the system)

No fixed I-O relation (e.g. dependency on earlier decisions)

### Federated and Transfer Learning affect AI Updates



### Research and Evaluation Pipeline on AI for Health



### Thank you very much!



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### Questions?

