Priorities, Challenges, and Barriers in Implementing Artificial Perception/Intelligence in CRC Screening and Surveillance

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Despite improvements to the tools that doctors use, hospitals are experiencing diminishing returns from better imaging, and doctor performance has stagnated.
3D High-Resolution Imaging
AI assisted pCLE Images Classification through CNN training + similarity (BOW) approach
“Describe the kinds of training data required to generate a usable AI model that would be able to identify >99% of polyps in real-time during colonoscopy?”

- All work to date is encouraging but more work needed for real-time
- False positives a problem
- Detection not all or nothing, unlike some aspects of optical biopsy
- What do investigators define as a polyp for their “AI” detection?
- What defines Deep Learning?
Polyp Detection---types of training data needed

- Videos, not “perfect” stills
- Concept of "tracking" and then "encoding" rather than "detection" per se
- “Clinical scenario” quality—stool, spasm, blurred frames, instruments
- Metadata---AI can “extract” information we don’t appreciate
- IEE data for sure, but also white light
- ? “Magnification” data---CLE, Endocytoscopy
- Include other imaging, genomic, treatment data---to allow for AI “prediction”
Figure 1. Full Colonoscopy Workflow Diagram
Quality indicators are not often well followed

Recommended withdrawal time

**WHY?**
Lack of supervision and practical tools!

Nearly half endoscopic physician did not meet the standard

Aasma Shaukat, et al. Gastroenterology 2015;1–6
3. Monitoring withdraw speed

Here, video clips from colonoscopies of different withdrawal time were shown. From the dashboard, we could see the real-time Yu speed of each colonoscopy.
GI Endoscopy: From Procedure to Cost Effective Patient Management

Augment
- Screening
  - Polyp detection

Transform
- Diagnostic
  - Polyp pathology prediction

Reveal

Treatment Planning
- ESD v EMR v Surgery

From Procedure to Cost Effective Patient Management
Workflow Integration
Potential downsides of implementing AI

- Decision support/second reader? Or primary reader?
- If primary, need “human in the loop” (HITL) in AI solutions
- Self driving car analogy---consumer and patient acceptance issues
- Data Security, Privacy & Traceability
- Threat to practice
- Billing implications/Insurance reimbursement
What is AI Safety?

AI + Cybersecurity = AI Safety & Security

Science and engineering aimed at creating safe and secure machines.
There is a glaring documentation gap in endoscopy

Electronic Health Record  Imaging Studies  Lab Results  Billing Data

Procedure videos are not being recorded
Challenges with traditional endoscopic video systems:

- Too complex for every day use
- Lack of security for hard media formats
- Difficult to scale for big data
Deep learning techniques work best when data is diverse, of high quality, and in massive quantity.

Cloud video capture helps meet these criteria.
Intelligent Real-time Image Segmentation™ (IRIS)
Invisible information brought to light with pCLE

**Endoscopy**
- X 30 Macroscopic analysis

**Biopsies**
- X 1000 Histology
- ex vivo microscopic analysis

**Cellvizio**
- Real time
- Compatible
- Video rate
- Functional imaging
- 1µm resolution

**Probe-based Confocal Laser Endomicroscopy (pCLE)** provides realtime optical sections of tissues

Mauna Kea Technologies
Thank you

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