Part 6
Lecture 1: Adopting AI Solutions in Medicine

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Who I am…

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Implementing Computer-Aided Diagnosis (CAD) and Artificial Intelligence (AI) in Clinical Practice

What is CDSS?

- Clinical Decision Support Systems (CDSS) provide clinicians with knowledge, filtered or presented at appropriate times, to enhance health and health care, and can be seen as an effective pathway to improve patient safety, providing, for instance, alerts for error reduction

- CDSS should make dynamic predictions, allowing interactions with clinicians and taking into consideration the longitudinal nature of health and disease

- The CDSS-RM reference model can contribute to optimized design of modeling methodologies, in order to improve response of health systems to clinical decision-making challenges

Characteristics of CDSS

- Temporally ordered steps, each leading to new data, which in turn becomes useful for a new decision
- Feedback loops where acquisition of new data improves certainty and generates new questions to examine
- Combining different kinds of clinical data for decision making
- Reusing the same data in two or more different decisions
- Clinical decisions requiring human cognitive skills and knowledge, to process the available information

Refresher: What is CADe?

- Computer-aided **detection**
- Goal: **reduce false negatives**
- Pattern recognition software that identifies suspicious features on an image and brings them to the attention of the radiologist

Refresher: What is CADx?

- Computer aided **diagnosis**
- Goal: analyze the likelihood that a feature in an image represents a specific disease process (ex. benign vs. malignant)
- The accuracy of traditional predefined feature-based CADx systems is contingent upon several factors, including the accuracy of previous object segmentations. It is often the case that errors are magnified as they propagate through the various image-based tasks within the clinical oncology workflow.

Where We Are With CAD/AI?

- There is lots of evidence showing that CAD and AI have observable benefits in diagnostic specificity and selectivity

- However, CAD and AI have not been implemented widely in the radiology workplace thus far

Where We Are With CAD/AI?

- In 2007, Doi et al. reached the conclusion that CAD was beginning to be applied and used in the clinical practice more frequently as a diagnostic tool, primarily to be used in the examination of abnormalities in medical images

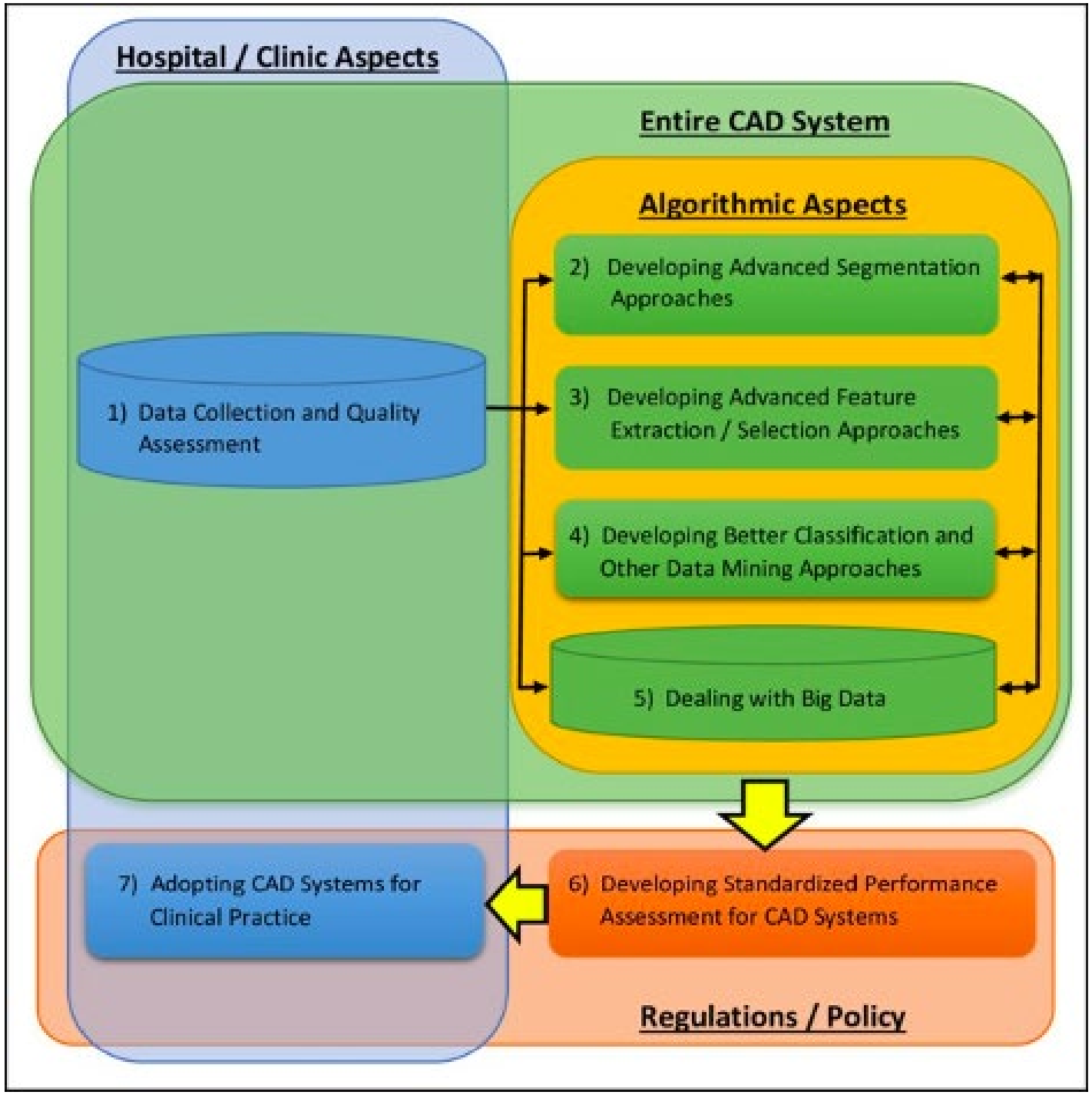
- Studies in recent years have also stated that CAD technology has shown major improvements, and that diagnostic accuracy rates would benefit from the implementation of CAD

Three Fundamental Ideas

- Basing the computer algorithms on the strategies and processes that would be involved in image readings by radiologists

- Protecting the intellectual properties related to CAD via patents to facilitate commercialization of CAD products

- Promoting CAD widely throughout the field of radiology (Doi, 2007)



Relations among the Seven Key Challenges in CAD. (Yanase & Triantaphyllou 2019)

What Needs to be Done

- In order for successful implementation of CAD/AI technology systems into clinical practice…
  - Necessary knowledge of the role CAD/AI will become standard within the workplace
  - Assurance that CAD/AI will serve as a tool rather than a complete replacement of radiologists

Primary Barrier to Implementation

- Radiologists do not trust CAD technology
- Possible facilitators to the implementation of CAD and AI are the age and training of radiologists at present, which allows for trained professionals to acclimatize to the adjustment more easily
- Although CAD is a subset of machine learning and artificial intelligence, a better understanding of all of these concepts throughout the clinical workplace is crucial

Other Barriers to Implementation

- ❑ Inconsistent technical performance
- ❑ Absence of guidelines/best practices
- ❑ Limited communication between departments
- ❑ Inconsistent acceptance/trust of radiologists
- ❑ Acceptance trust of referring clinicians
- ❑ Reframe professional identity/responsibilities
- ❑ Regulatory and legal uncertainties
- ❑ Legal responsibility for mistakes

UTAUT

- Unified theory of acceptance and use of technology:
  - Model that evaluates how and why individuals adopt new information technologies, and is the product of the amalgamation of several models and theories of individual acceptance such as…
    - The Theory of Reasoned Action
    - The Technology Acceptance Models (TAMs)
    - The Motivation Model (MM)
    - The Theory of Planned Behaviour (TPB)

Four Central Constructs

- The four central constructs that have been identified to have significant roles on user acceptance and usage behaviour are...
  - Performance expectancy: Degree to which an individual believes that using the system will help him or her attain gains in job performance
  - Effort expectancy: Degree of ease associated with the use of the system
  - Social influence: Degree to which an individual perceives that important others believe he or she should use the new system
  - Facilitating conditions: Degree to which an individual believes that an organizational and technical infrastructure exists to support

How the UTAUT is Applied

- There has been an increasing use of information technology/systems (IT/IS) across the health sector, and a shift in the usage of the TAMs to the UTAUT because the UTAUT can explain up to 70% of usage intention variance (Aggeledis and Chatzoglou, 2009)
  - We can better learn from and understand how to correctly apply CAD and AI amongst radiologists

CAATTs

- Computer-aided auditing techniques and tools (CAATTs) and auditors have a striking resemblance to CAD and radiologists
  - CAATTs are utilized by and work with auditors to enable a greater efficiency and ability in processing information of audit significance obtained from information systems, compared to that of auditors alone (Mahzan and Lymer, 2014)

Gap in the Literature

- Existing literature cannot predict what is required for the Computer-aided diagnosis, and artificial intelligence to be adopted by radiologists

- There needs to be future studies conducted to investigate the barriers and facilitators to CAD and AI implementation

End of Lecture 1

Next up Part 6 Lecture 2: Future of AI in Medicine