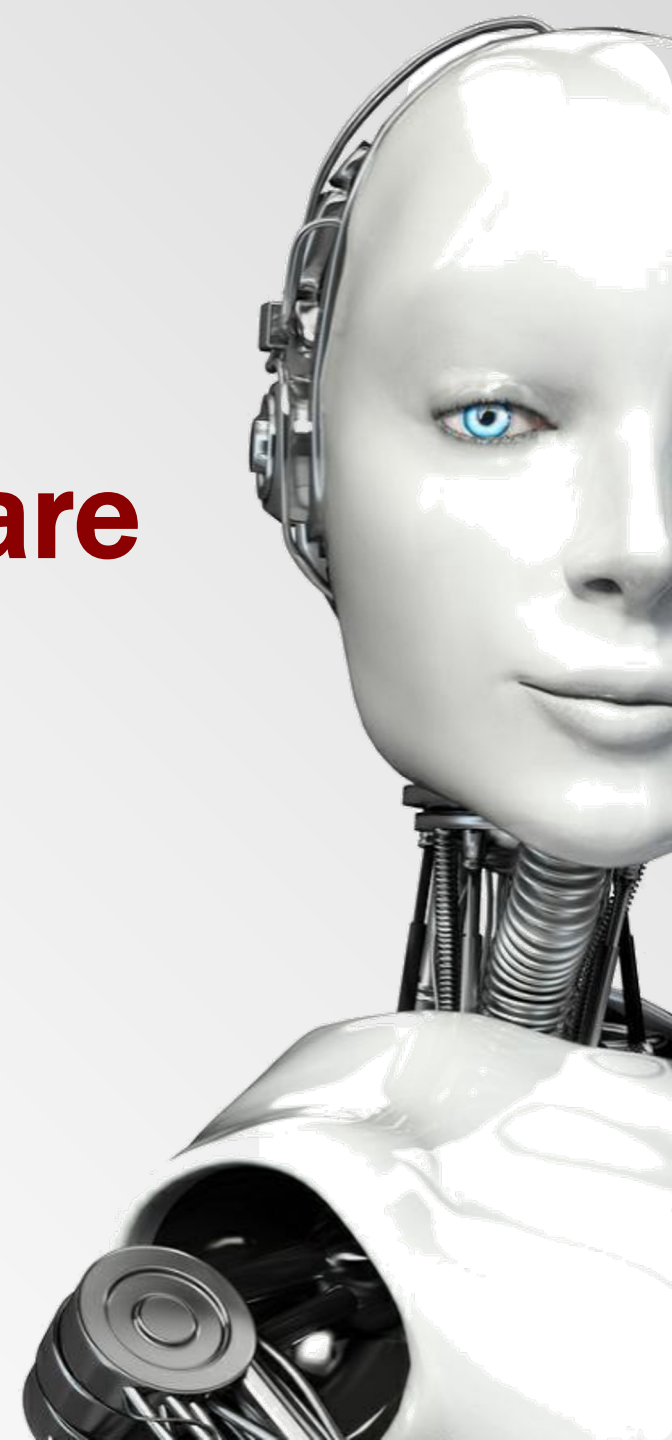




AI in Medicine & Healthcare Ventures

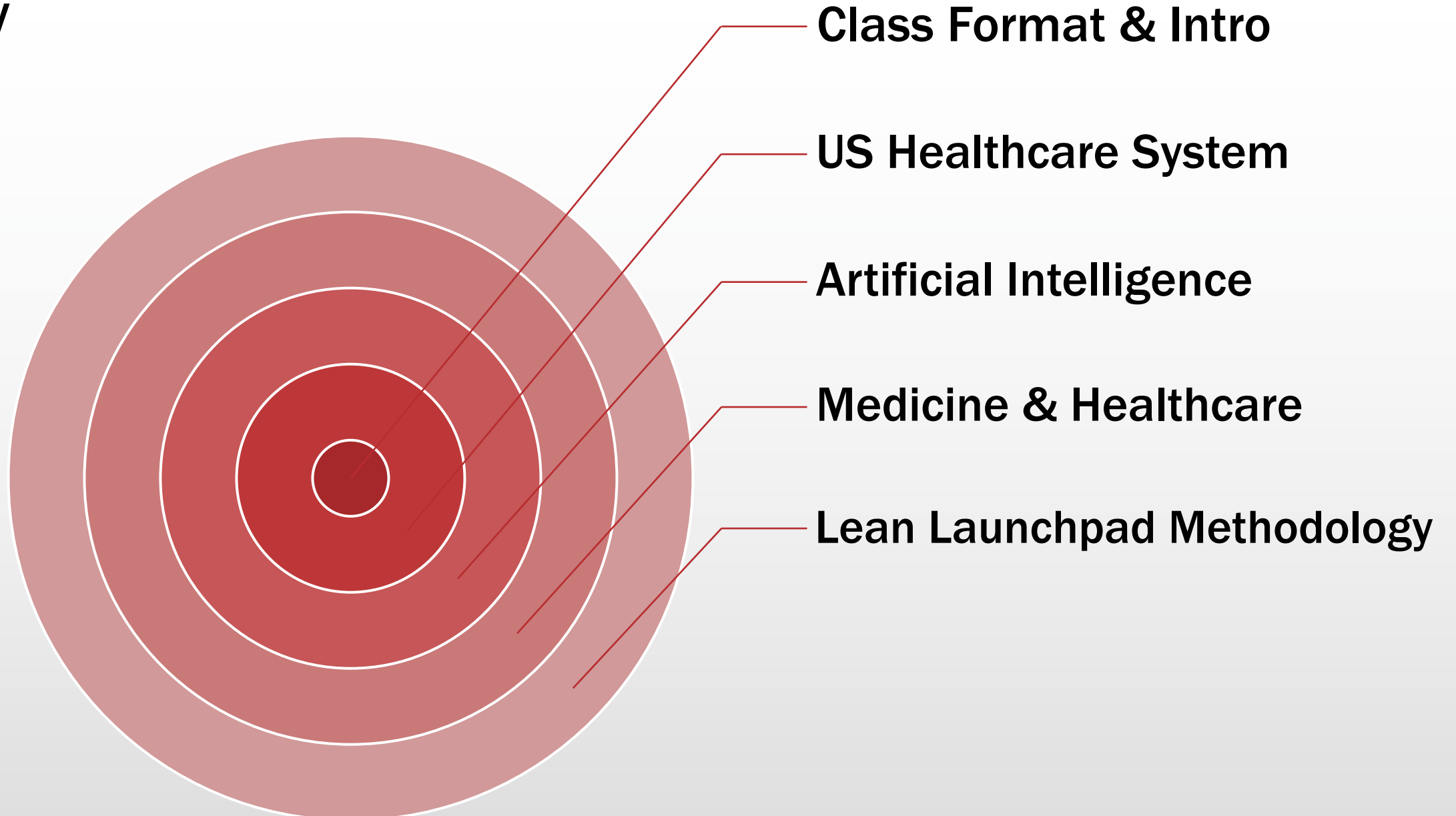
PSYC180/MED180

Spring 2023

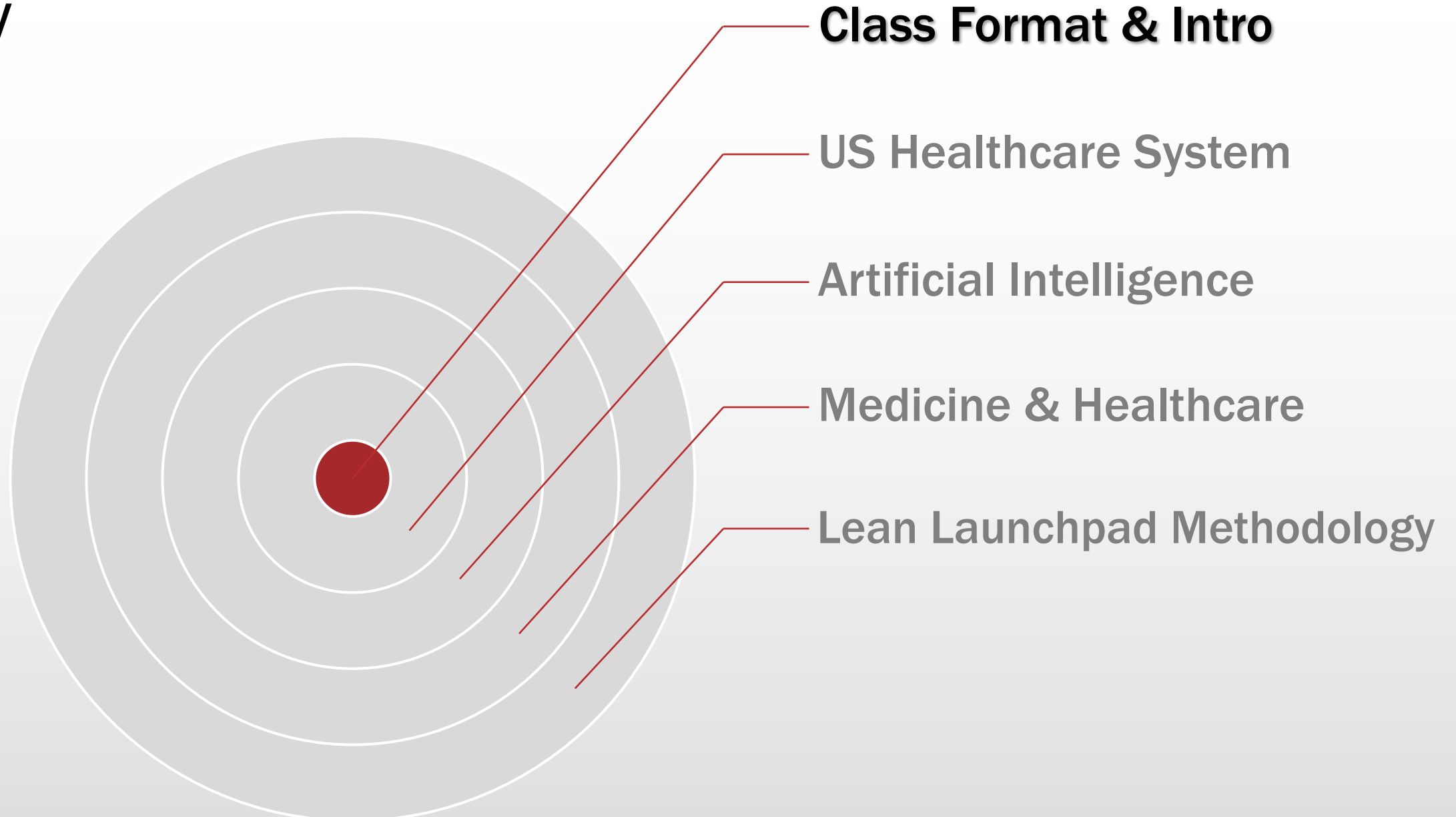


Stanford
MEDICINE

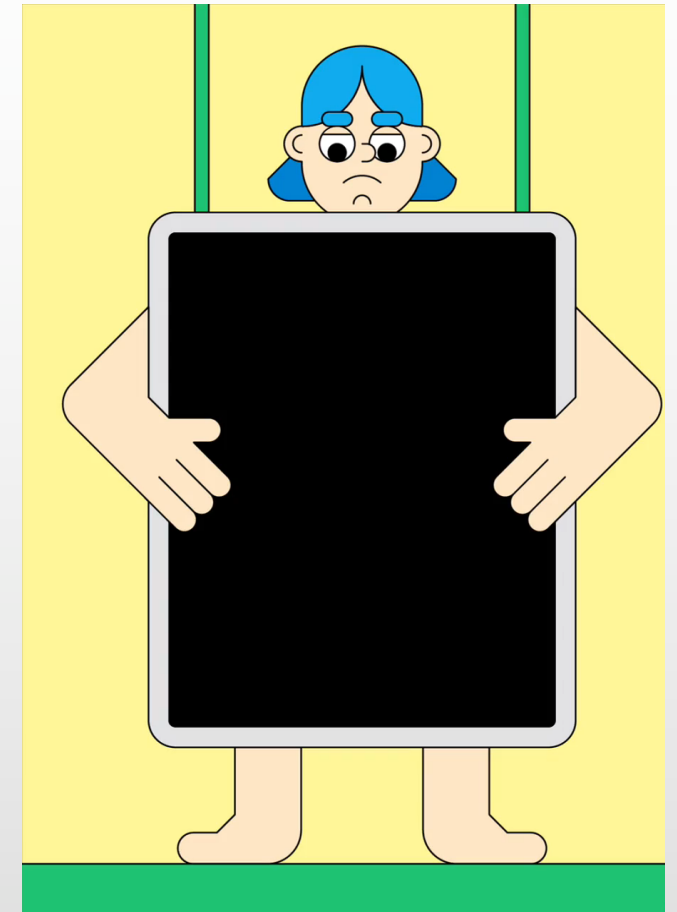
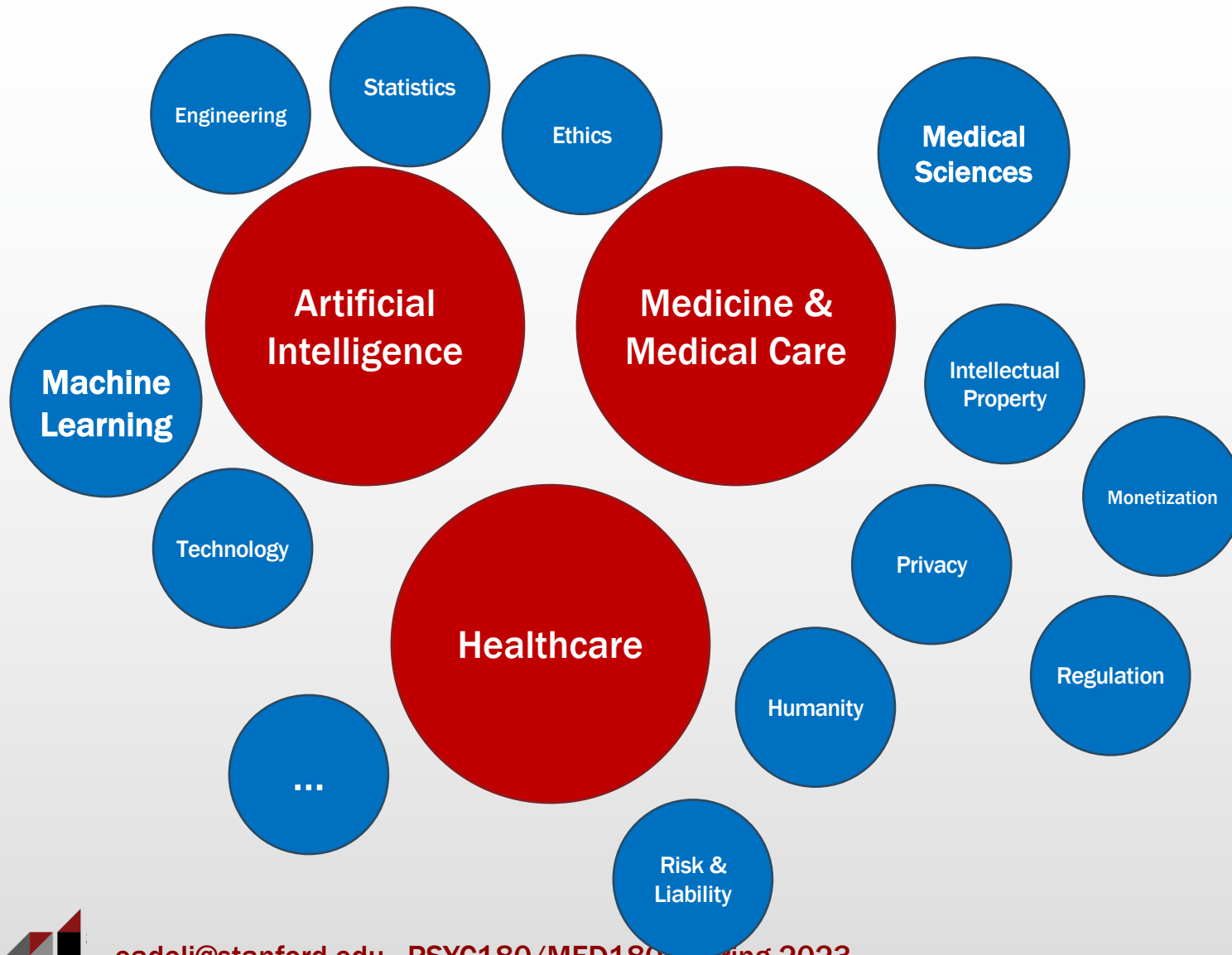
Today



Today



AI in Medicine & Healthcare



Instructor and Office Hours



**Ehsan Adeli, Ph.D.,
Computer Science,
AI, Healthcare, Neuroscience**

Office hours: Coordinated via email (or Tuesdays 1:30-2:30pm)

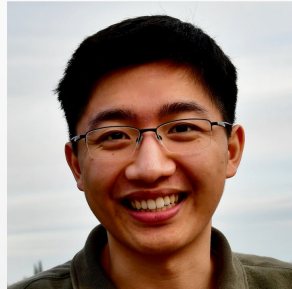
Location: Gates Building Rm 300 (or Zoom)



Thanks

Stephen Su

CS Student



Daniel Wu

CS Student



Edwin Pan

EE Student



Student Initiated Course in 2021

MED 18SI

Artificial Intelligence in Medicine and Healthcare Ventures

Department of Medicine, Stanford University, Spring 2021



Hello
my name is

DIVERSITY

Class

- Location Building 420 - Main Quad, Room 041
- Zoom (only accessible through Canvas). Please do not share the Zoom links outside the class.
- Time: Tuesdays 11:30am - 1:20pm
- Course Website:
 - <https://aimedv.Stanford.edu/>
- Canvas:
 - PSYC180: <https://canvas.stanford.edu/courses/174256>
 - MED180: <https://canvas.stanford.edu/courses/175858>



Format












1-Unit

- **lecture only, 11:30AM-12:30PM**
- **Students are encouraged to stay** for the second half too
- **Grading:** Submit a summary of each week's lecture, question asked in the class (assignments, link on the website)






2-Units

- **attending discussion section in a Lean LaunchPad-style training program**
- Completing a project in a team (team-based learning)
- **Grading:** Deliver a pitch presentation in front of an invited Panel



Week 1	April 4, 2023 11:30am-12:30pm	 <p>Ehsan Adeli Course Instructor</p> <ul style="list-style-type: none"> • Introduction [20 min] • Course Overview [10 min]: Goals, logistics, and the project • U.S. Healthcare System Overview [20 min] • Opportunity Evaluation (for course projects) [10 min] 	<p>A Digital Health Playbook An overview of various digital health companies, their business models, and what worked or didn't work</p>	Week 5 May 2, 2023 11:30am-12:30pm	 <p>Jordan Jacobs Co-Founder & Managing Partner at Radical Ventures Co-Founder & Founding Board of Directors at Vector Institute Board Of Directors at CIFAR (the Canadian Institute for Advanced Research)</p>	<p>Technologies on the Horizon Upcoming companies, problem areas, and policy breaks</p>
	12:30pm-1:20pm	 <p>Stephen Su, Stanford CS/MCS Student Founded startups at the intersection of health policy and data</p>			<p>Ehsan Adeli Course Instructor</p>	
Week 2	April 11, 2023 11:30am-12:30pm	 <p>Robert Chess Lecturer at Stanford Graduate School of Business</p>	<p>The Healthcare Landscape Stakeholders and major players</p>	Week 6 May 9, 2023 11:30am-12:30pm	 <p>Gopi Prashanth Founder, Spyn Inc Director Of Technology, Artificial Intelligence Systems, at Amazon Director Of Technology, Computer Vision & Artificial Intelligence at Amazon Go</p>	<p>Case Study: Building to Solve the Problem at Scale Building to scale is what most entrepreneurial startups do. There is another kind of innovation, which is building to solve the problem which is already at scale. Gopi can speak to both ends of this spectrum and the similarities and differences in entrepreneurial mindset that is required to solve the myriad of challenges throughout the journey.</p>
	12:30pm-1:20pm	<p>Ehsan Adeli Course Instructor</p>			<p>Team building Project planning and preparing for lean lunchpad training</p>	
Week 3	April 18, 2023 11:30am-12:30pm	 <p>David Entwistle President and CEO of Stanford Healthcare (SHC)</p>	<p>The Healthcare Landscape Current tools and techniques</p> <p>How SHC is utilizing AI.</p>	Week 7 May 16, 2023 11:30am-12:30pm	 <p>Radoslaw (Radek) Chrapkiewicz Director of Engineering, Stanford Department of Biology</p>	<p>Team building and leadership practices in healthcare and medicine</p>
	12:30pm-1:20pm	<p>Ehsan Adeli Course Instructor</p>			<p>Search versus Execution Search for a business model in the healthcare climate</p>	
Week 4	April 25, 2023 11:30am-12:30pm	 <p>Kevin Schulman Professor of Medicine, Associate Chair of Business Development and Strategy in the Department of Medicine Director of Industry Partnerships and Education for the Clinical Excellence Research Center (CERC) Professor of (by courtesy) Operations, Information and Technology at Stanford's Graduate School of Business</p>	<p>Healthcare Landscape, current tools, techniques, and pitfalls Economics of healthcare</p>	Week 8 May 23, 2023 11:30am-12:30pm	 <p>Vivien Ho Partner at Pear VC, with a focus on health Founder of the Pear Female Founders Circle (supporting female technical founders)</p>	<p>Healthcare Innovation Practical considerations and common pitfalls</p> <p>Preparing and pitching ideas, as well as selling into traditional health systems and different GTM dynamics and benefits</p>
	12:30pm-1:20pm	 <p>Marcella Garcia Senior Software Quality Engineer at MEDicept Inc. Former Vice President of Regulatory Affairs and Quality Assurance Neurostimulation and Active Implantables (2022-2023 @ Nia Therapeutics); Medical Device (2018-2023 @MGRQA) Former Director of Quality and Compliance Predictive Analytics Population Health (2021-2022 @ Health Data Analytics Institute); Digital Therapeutics (2019-2021 @ Happify Health)</p>			<p>Healthcare Tech Landscape from a regulatory point of view: A discussion around Medical Devices, Software as a medical device (SaMD), FDA, Quality, and aspects</p>	
				Week 8 May 23, 2023 12:30pm-1:20pm	 <p>Kimberley Powell Vice President and General Manager, Healthcare at NVIDIA</p>	<p>Case Study: Healthcare Innovation, Integrating and scaling technologies within large healthcare systems</p>
					<p>Ehsan Adeli Course Instructor</p>	



Week 8	May 23, 2023 11:30am-12:30pm	 Kimberley Powell Vice President and General Manager, Healthcare at NVIDIA	Case Study: Healthcare Innovation, Integrating and scaling technologies within large healthcare systems
	12:30pm-1:20pm	Ehsan Adeli Course Instructor	Teamwork
Week 9	May 30, 2023 11:30am-12:30pm	 Jonathan Berent CEO of NextSense Inc, Life-Hacker, Director @ X, Moonshot Factory	Case study Unlocking brain health with real-world data insights and practical, scientific wisdom for daily living
	12:30pm-1:20pm	 Leo Grady Founder and CEO of new AI healthcare company (stealth) CEO in Residence at Breyer Capital Former CEO of Paige (2019-2021) and Senior Vice President of Engineering at HeartFlow Inc (2012-2019)	Case Study: leading development and commercialization of advanced machine learning, AI, computer vision, diagnostic and digital health technologies that have made a significant impact on healthcare practice
Week 10	June 6, 2023 11:30am-1:20pm	Students and Ehsan Adeli, Course Instructor	Pitch Project Presentations Panelists: <ul style="list-style-type: none"> • Vivien Ho, Partner at Pear VC (Investing in health: human, planet and financial health) • Jay Rughani Partner at Andreessen Horowitz (Bio + Health investing team) • Partner at Radical VC  

- **First half of the class:**
 - Seminar
- **Second half:**
 - Discussing teams and projects



Team Building

- Start forming teams
- Enter info here (Deadline April 11):
 - <https://forms.gle/sdyTr8whWbqQxTFY9>

Teams and Teammates - PSYC180/MED180 - Spring 2023

Form description

This form is automatically collecting emails for Stanford University users. [Change settings](#)

0- Name *

Short answer text

1- Have you already selected your team members? *

Yes

No

2- If you answered 'Yes' to Question 1, enter the SUNet IDs of all team members (including users).

Long answer text

2.1- Are all team members enrolled in the course? If not, explain.

Long answer text

3- If you selected 'No' for Question 1, please write three paragraphs about yourself. In each paragraph, please summarize

(i) the areas of your expertise (mention which program you are currently studying in)

(ii) talk about your personal skills

(iii) what you are looking for in a teammate

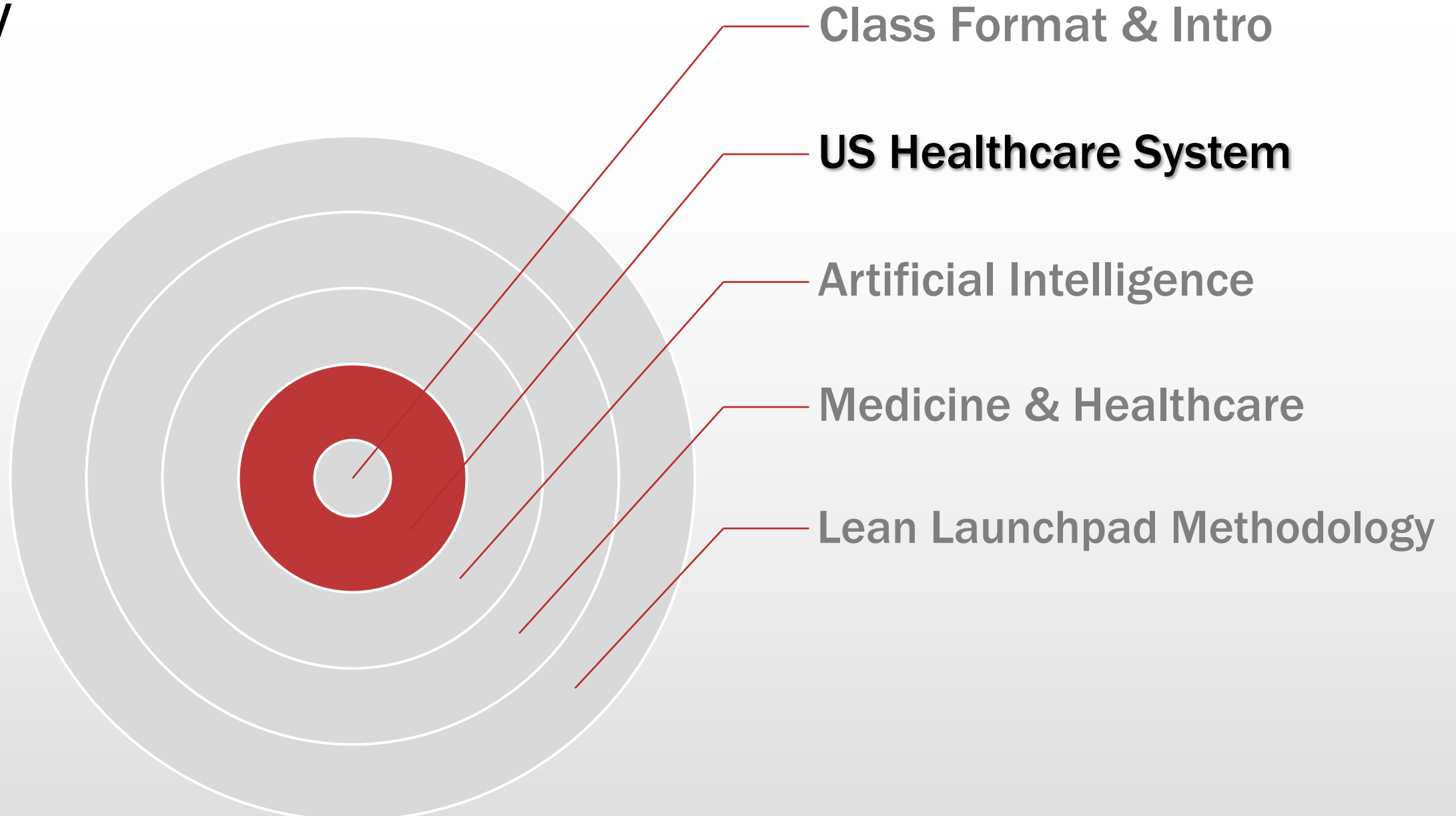
Long answer text



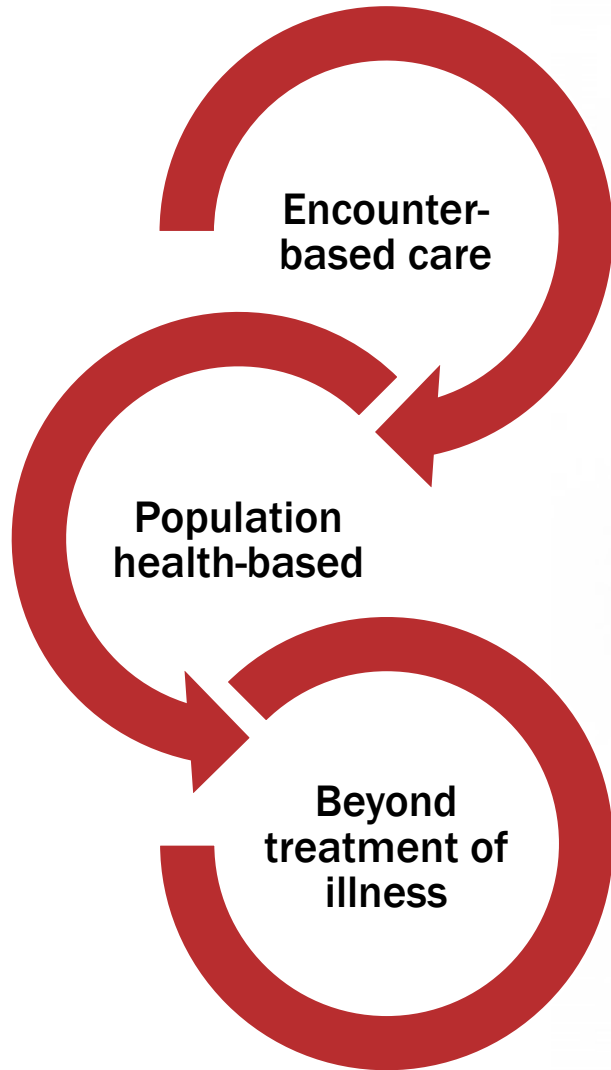
Questions?



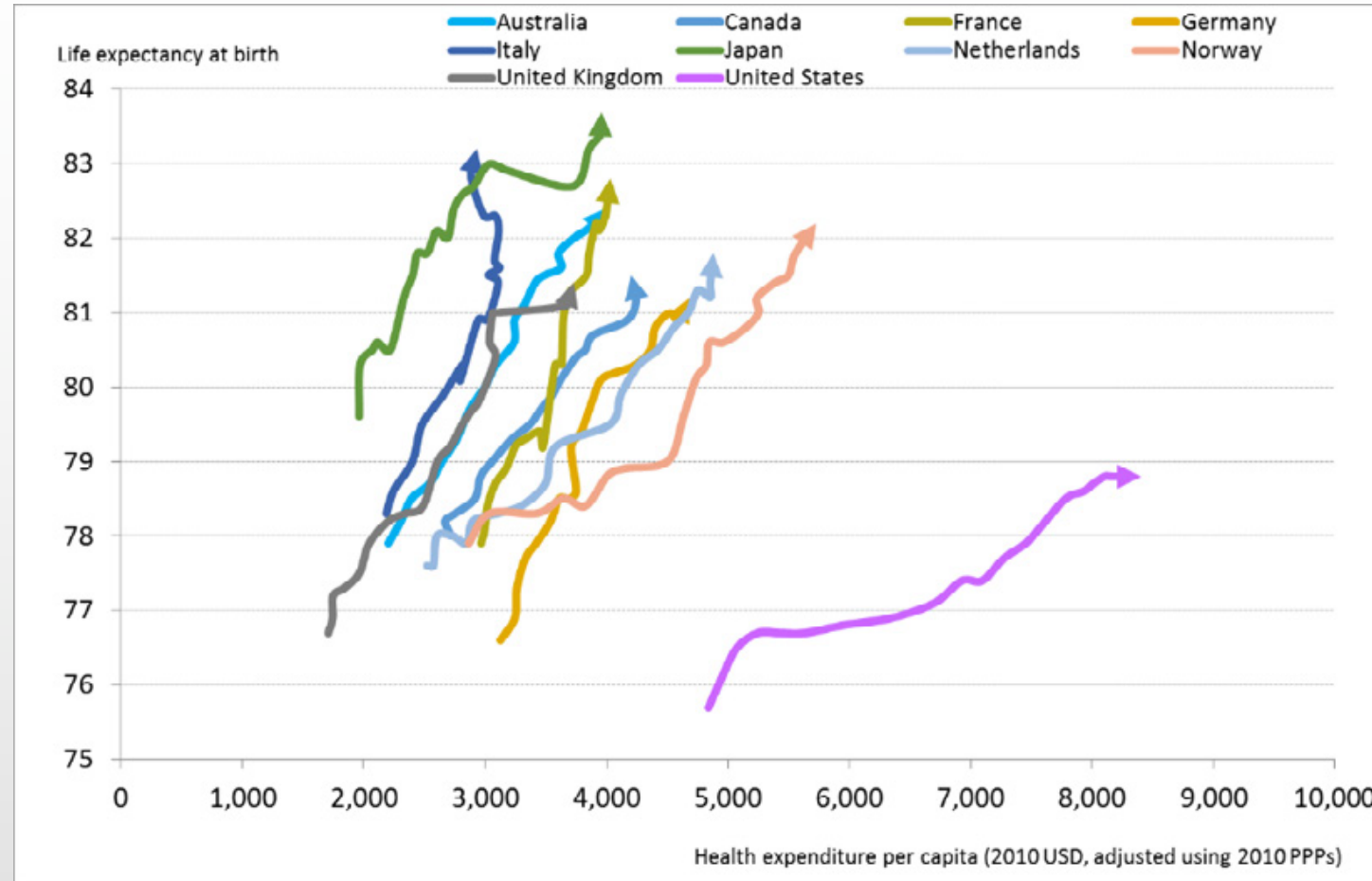
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U.S. Health System



U.S. Health System (cont'd)



https://doi.org/10.1787/health_glance-2017-en

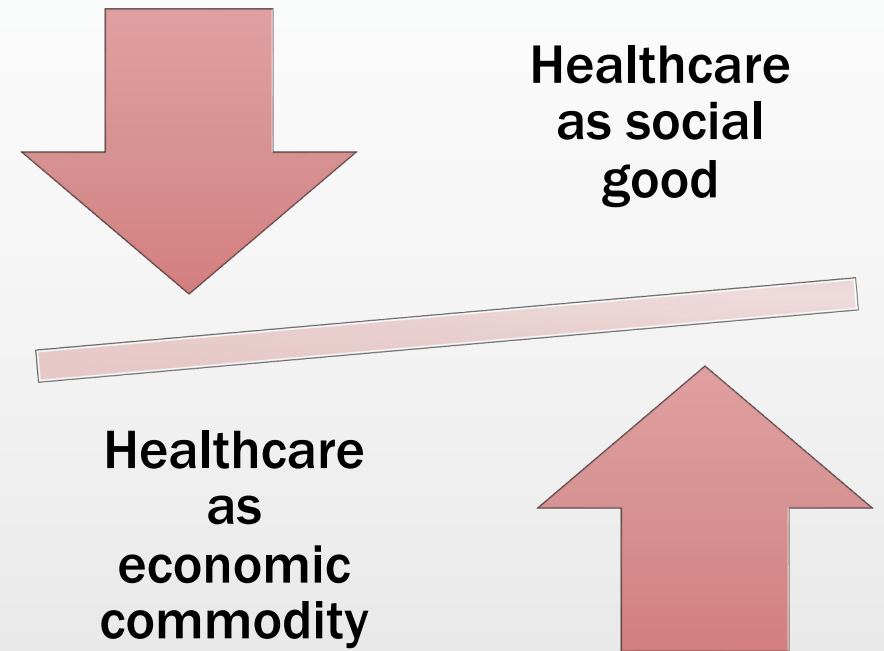
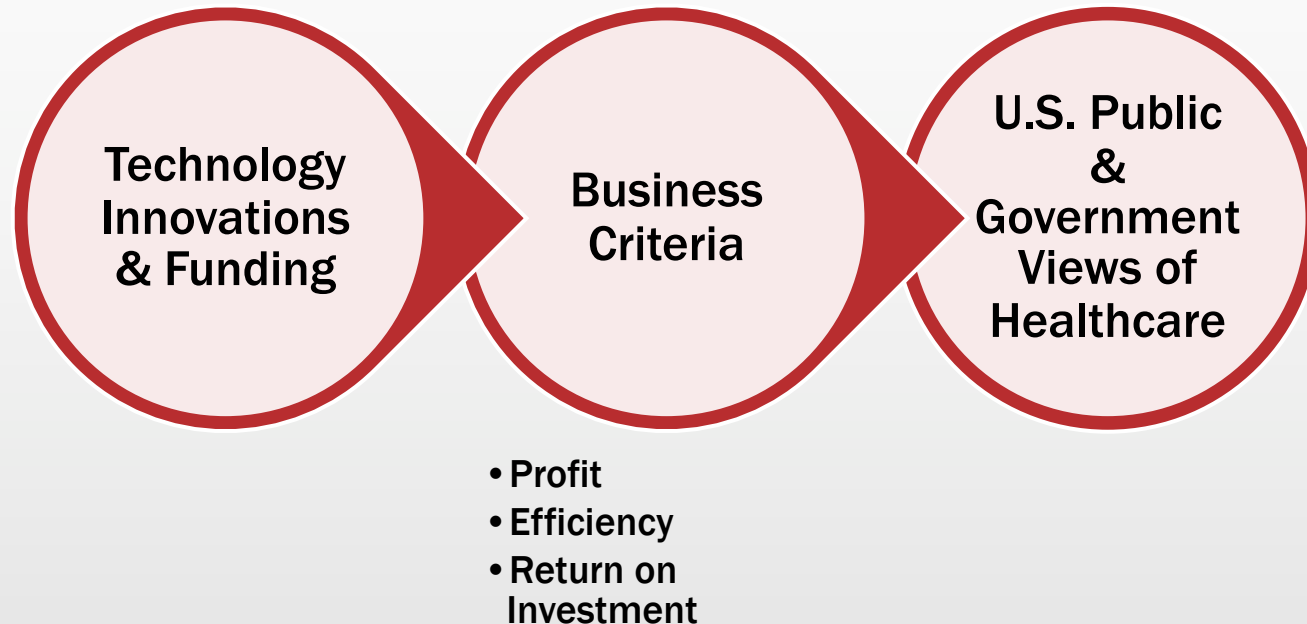


Where & How AI Provides Opportunities for Improvement

- Current context of healthcare and drivers for its change
 - Automation
 - Information synthesis and recommendation
- To
 - Patients
 - fRamilies (friends and family)
 - Clinical team



Where & How AI Provides Opportunities (cont'd)



Where & How AI Provides Opportunities (cont'd)

- Use cases:
 - reduce cost and gain efficiencies through prioritizing human labor focus on more complex tasks
 - identify workflow optimization strategies
 - reduce medical waste
 - failure of care delivery,
 - failure of care coordination,
 - overtreatment or low-value care,
 - pricing failure,
 - fraud and abuse,
 - administrative complexity
 - automate highly repetitive business and workflow processes by using reliably captured structured data



Where & How AI Provides Opportunities (cont'd)

Critical to be

- thoughtful,
- equitable,
- inclusive

To avoid

- adverse events
- unintended consequences

Ensuring that AI tools

- align with the preferences of users and end targets
- do not exacerbate historical inequities in access and outcomes



National Academy of Medicine Report

- Stakeholders
 - AI model developers,
 - clinical implementers,
 - clinicians and patients,
 - regulators,
 - policy makers
 - ...
- Outlines key considerations for moving forward

THE LEARNING HEALTH SYSTEM SERIES

Artificial Intelligence in Health Care

The Hope, the Hype, the Promise, the Peril

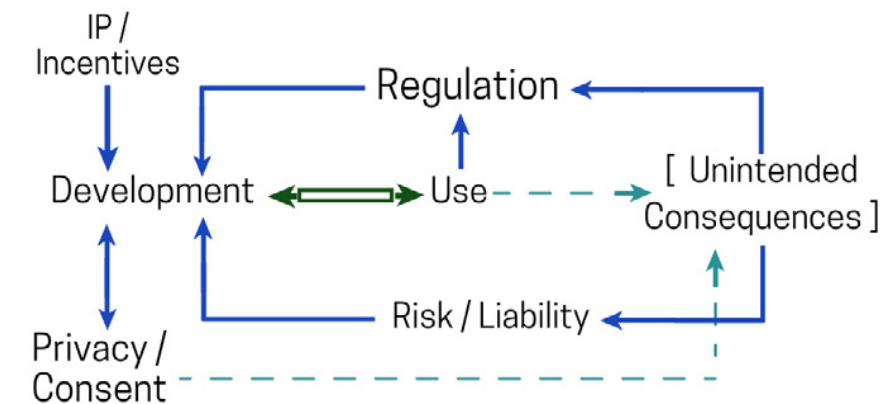
Michael Matheny,
Sonoo Thadaney Israni, Mahnoor Ahmed,
and Danielle Whicher, *Editors*

 NATIONAL ACADEMY OF MEDICINE



Summary

- **Population-representative data** accessibility, standardization, quality is vital
- **Ethical** health care, equity, and inclusivity should be prioritized
- The dialogue around **transparency** and trust should change to be domain- and use-case differential
- Near-term focus should be on **augmented intelligence** rather than full automation
- Develop and deploy **appropriate training and educational programs** to support health care ai
- **Leverage existing frameworks** and best practices within the learning health care system, human factors, and implementation science
- **Balancing** degrees of regulation and legislation of AI to promote innovation, safety, and trust



This week's assignment



Healthcare is hard



Selling into healthcare is hard

Healthcare is generally BIG, SLOW, and BUREAUCRATIC

Adoption of innovation lags

the regulatory and compliance environment leads to deal cycles that are at minimum 6 months, but more likely a year

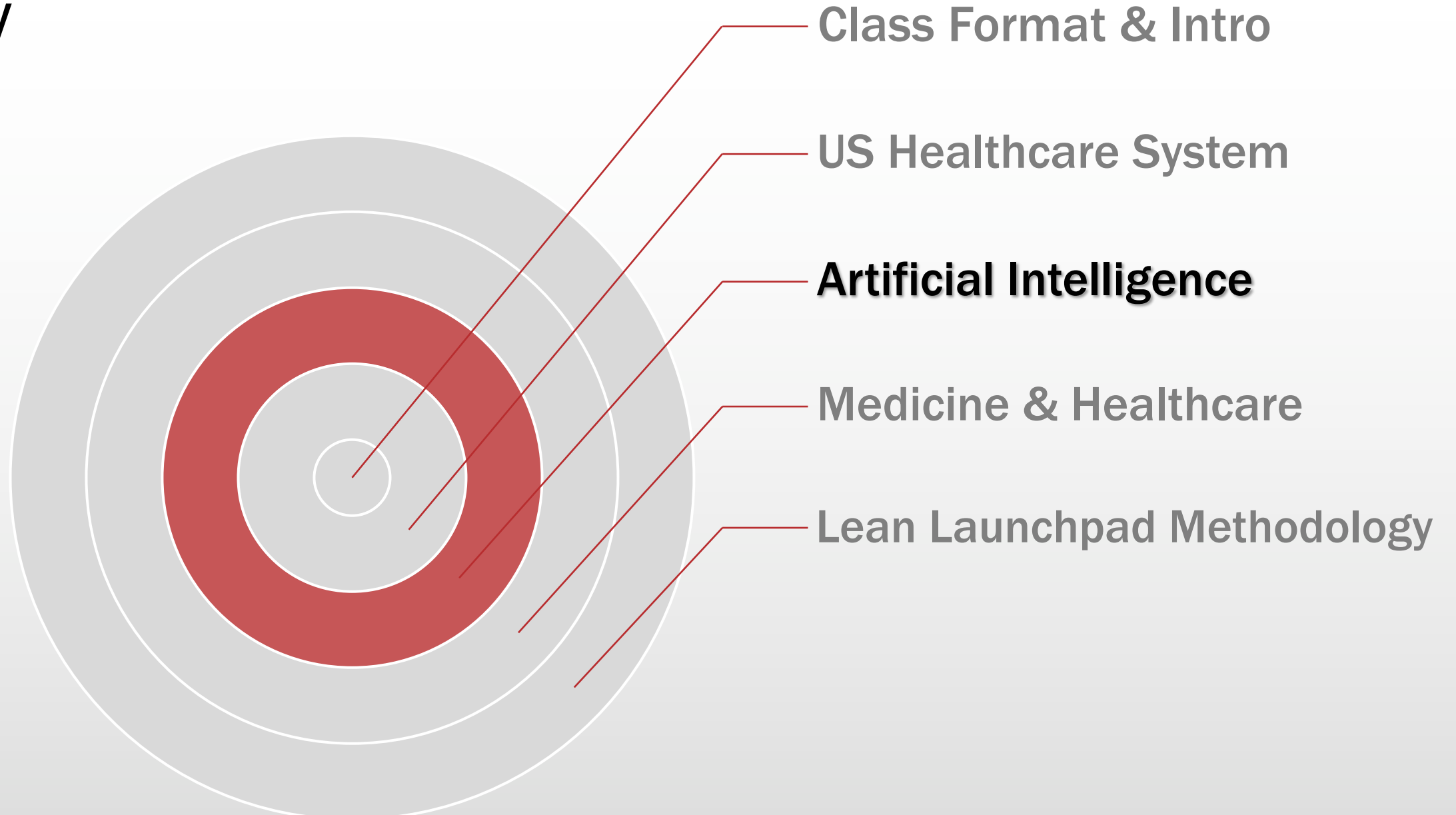
Sell into healthcare organizations,

- the hurdles to overcome,
- how not to get stuck in a "pilot" mode,
- understanding payment models and deal structure

The general belief is that the next company that rises to be the largest company in the world will likely be a healthcare company!



Today



Meaning

artificial intelligence noun

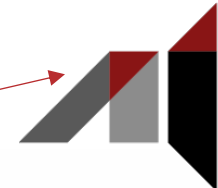
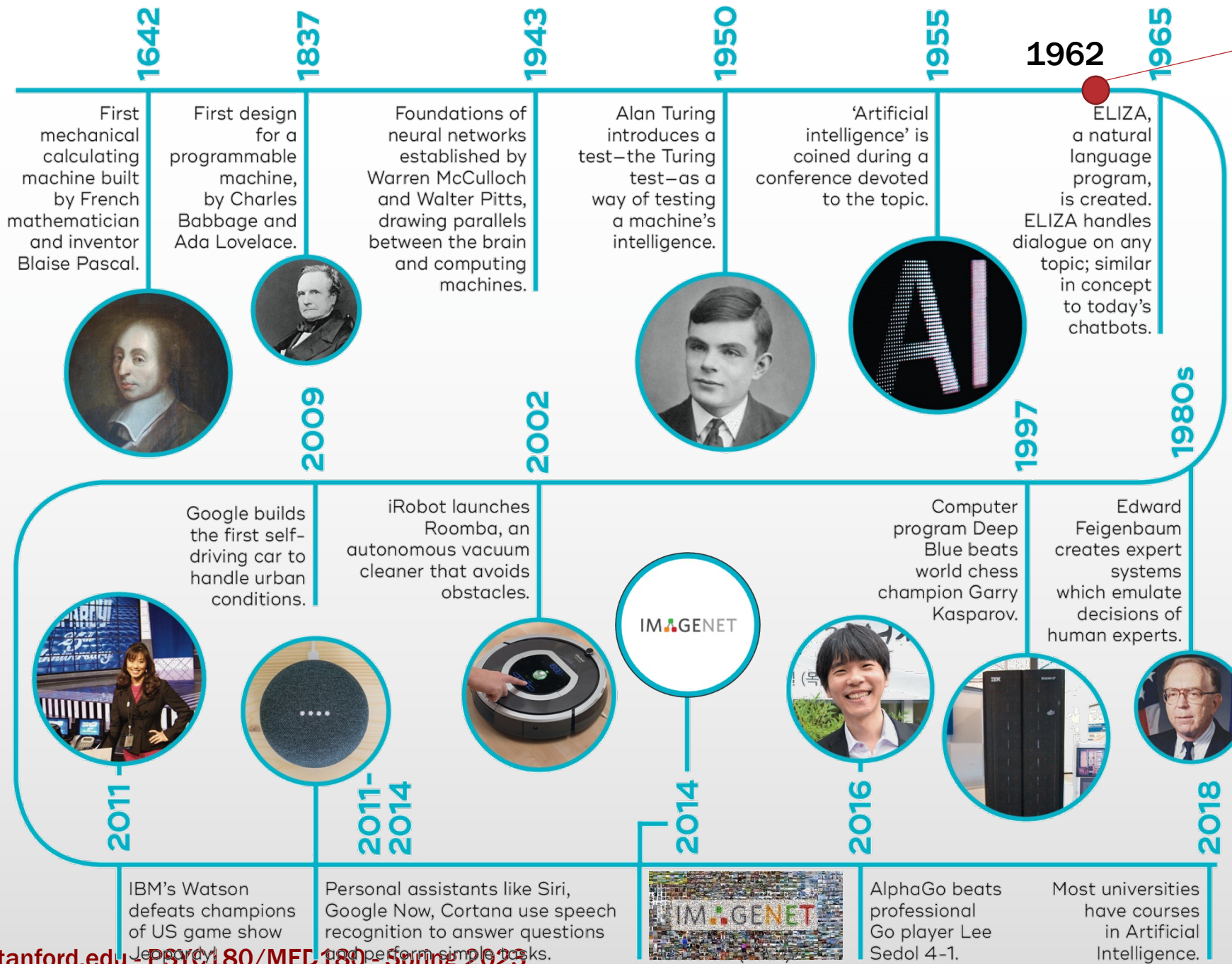


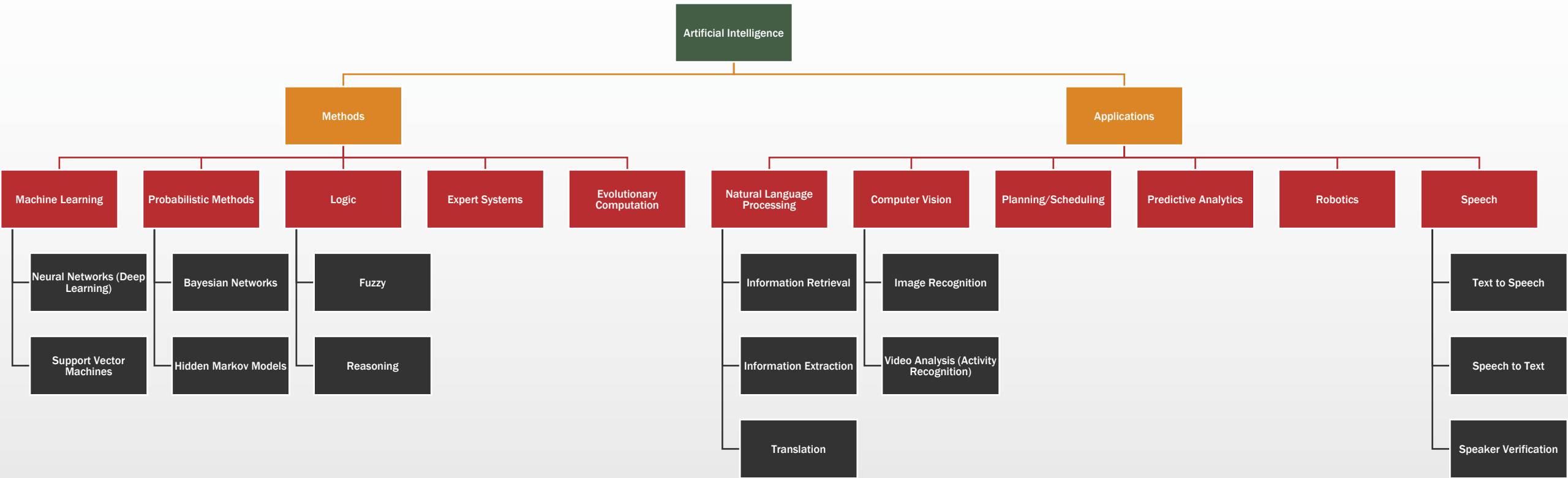
Definition of *artificial intelligence*

- 1 : a branch of computer science dealing with the simulation of intelligent behavior in computers
- 2 : the capability of a machine to imitate intelligent human behavior

- AI systems:
 - model human reasoning to solve a problem
 - ignore human reasoning and exclusively use large volumes of data to generate a framework to answer the question(s) of interest
 - attempt to incorporate elements of human reasoning but do not require accurate modeling of human processes.

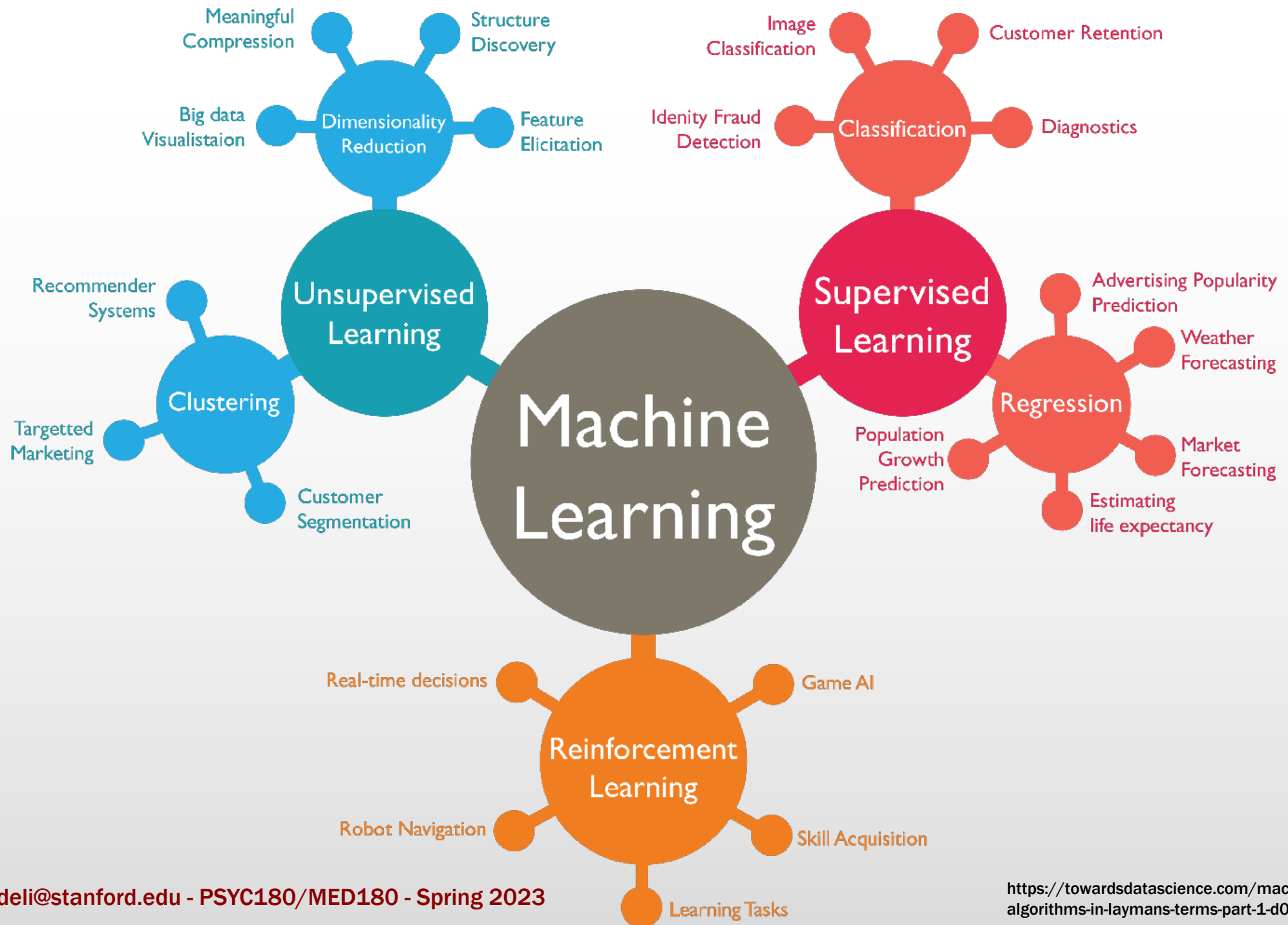




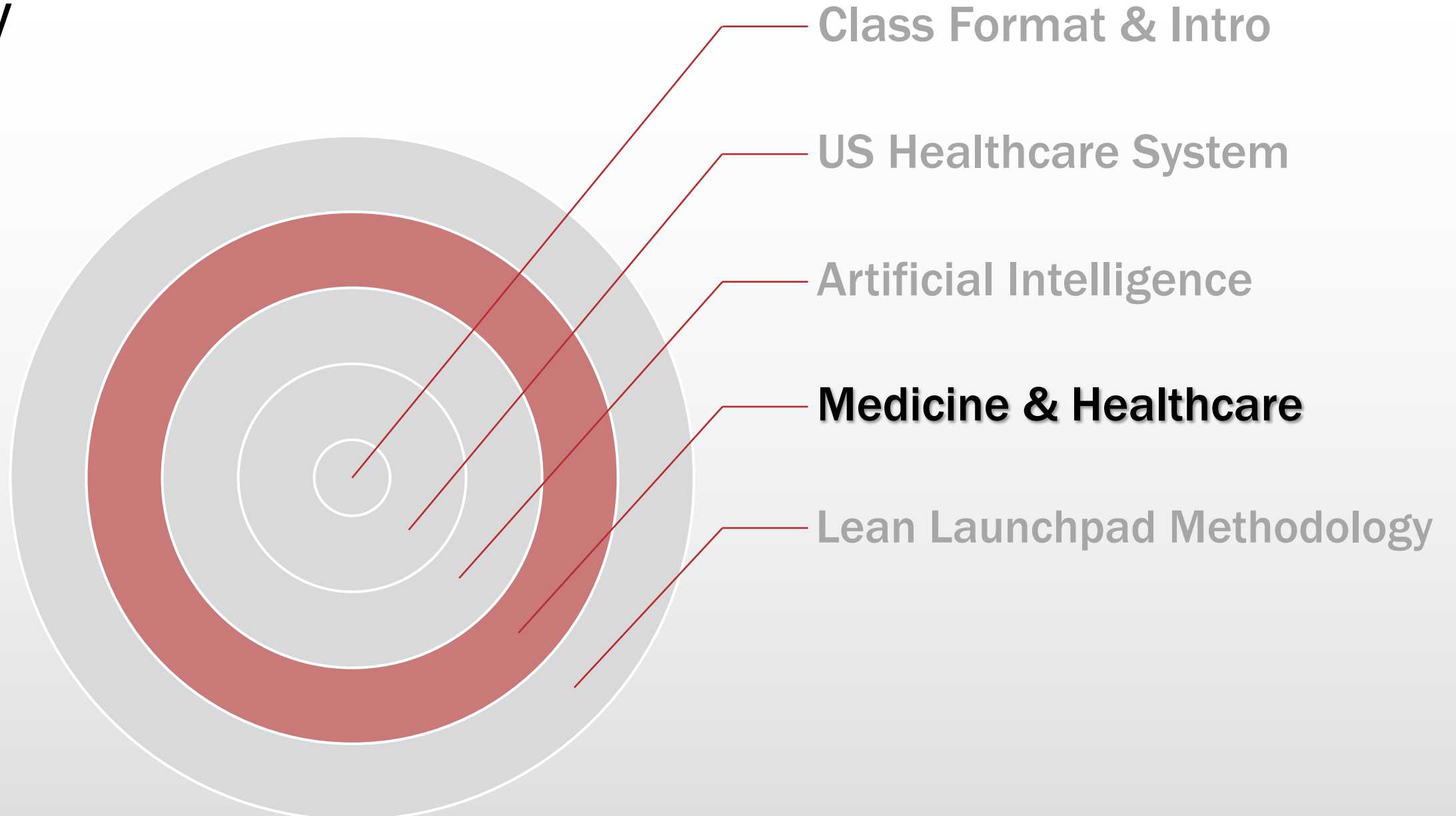


Large Language Models (LLMs)

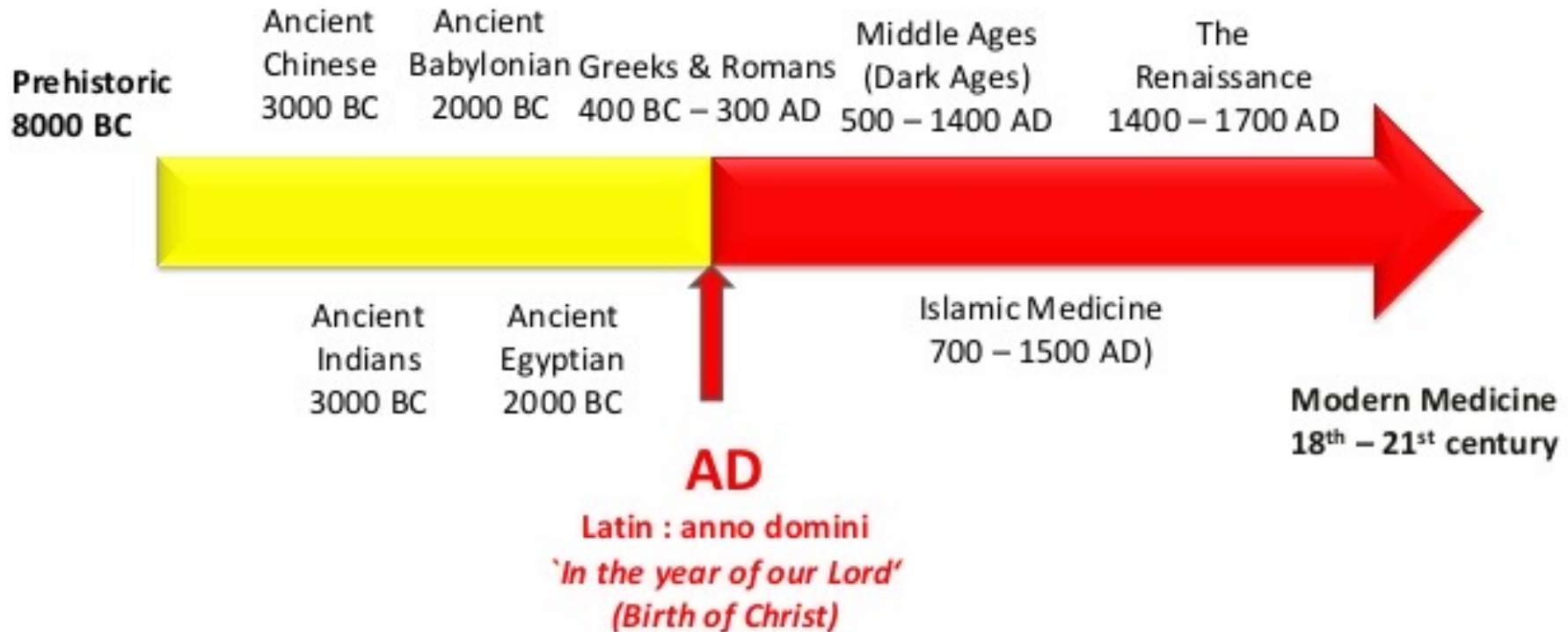




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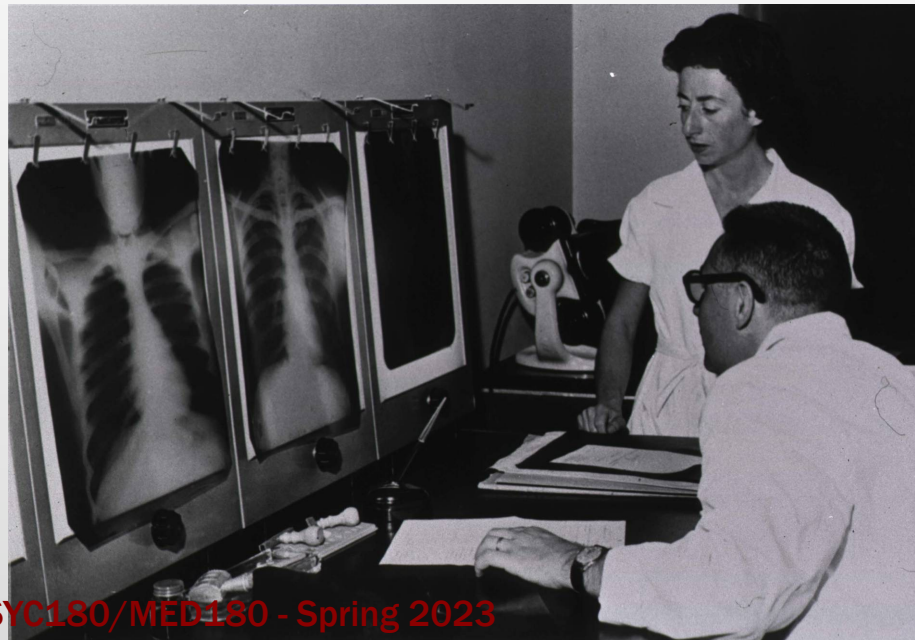


Timeline of Medical History



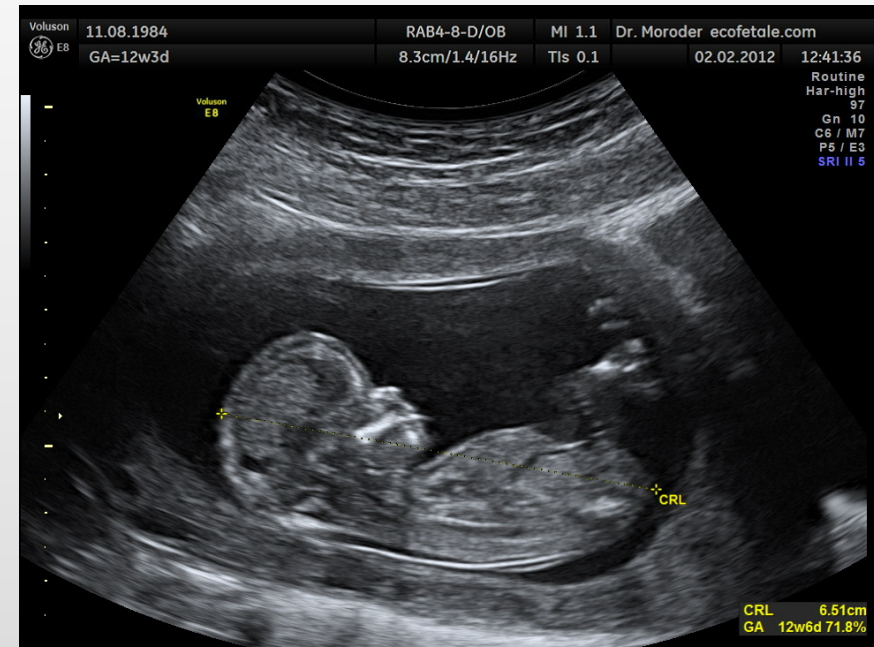
Innovations in Medical and Biological Engineering

- 1950s and earlier
 - Artificial Kidney
 - X ray
 - Electrocardiogram
 - Cardiac Pacemaker
 - Cardiopulmonary bypass
 - Antibiotic Production technology
 - Defibrillator



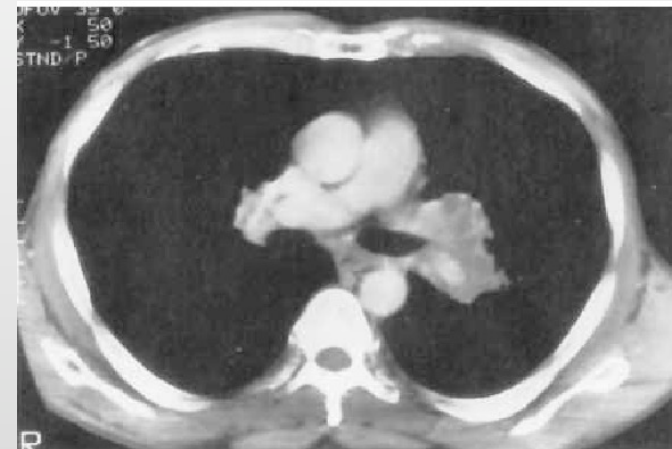
Innovations in Medical and Biological Engineering

- 1950s and earlier
 - Artificial Kidney
 - X ray
 - Electrocardiogram
 - Cardiac Pacemaker
 - Cardiopulmonary bypass
 - Antibiotic Production technology
 - Defibrillator
- 1960s
 - Heart valve replacement
 - Intraocular lens
 - Ultrasound
 - Vascular grafts
 - Blood analysis and processing



Innovations in Medical and Biological Engineering

- 1950s and earlier
 - **Artificial Kidney**
 - X ray
 - Electrocardiogram
 - **Cardiac Pacemaker**
 - Cardiopulmonary bypass
 - **Antibiotic Production technology**
 - Defibrillator
- 1970s
 - **Computer assisted tomography**
 - Artificial hip and knee replacements
 - Balloon catheter
 - Endoscopy
 - Biological plant food engineering



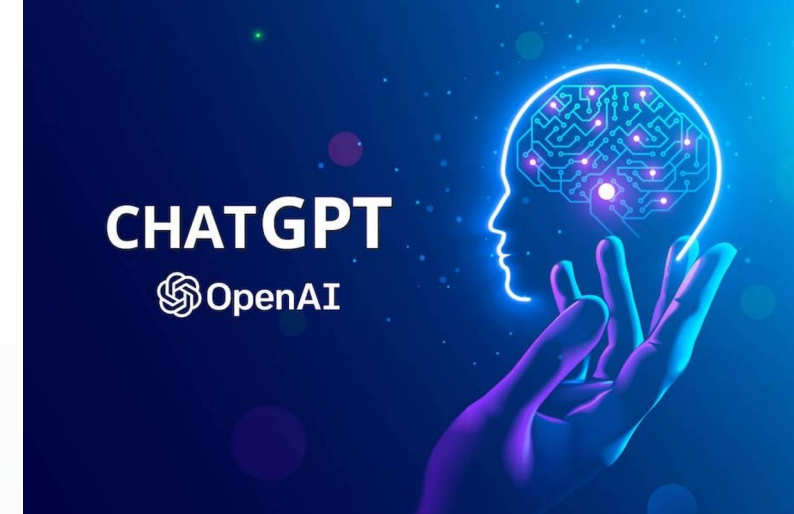
Innovations in Medical and Biological Engineering



- 1980s
 - **Magnetic resonance imaging**
 - Laser surgery
 - Vascular grafts
 - Recombinant therapeutics
- Present day
 - **Genomic sequencing and microarrays**
 - Positron Emission tomography
 - **Image guided surgery**



Conversational AI



**WHAT IS CHAT-GPT,
THE AI CHATBOT
THAT'S TAKING THE
INTERNET BY STORM**



- Medical Note Taking
- Inference over Innate Medical Knowledge
- Medical Consultation
- ...

The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL REPORT

Jeffrey M. Drazen, M.D., *Editor*;
Isaac S. Kohane, M.D., Ph.D., and Tze-Yun Leong, Ph.D., *Guest Editors*

AI IN MEDICINE

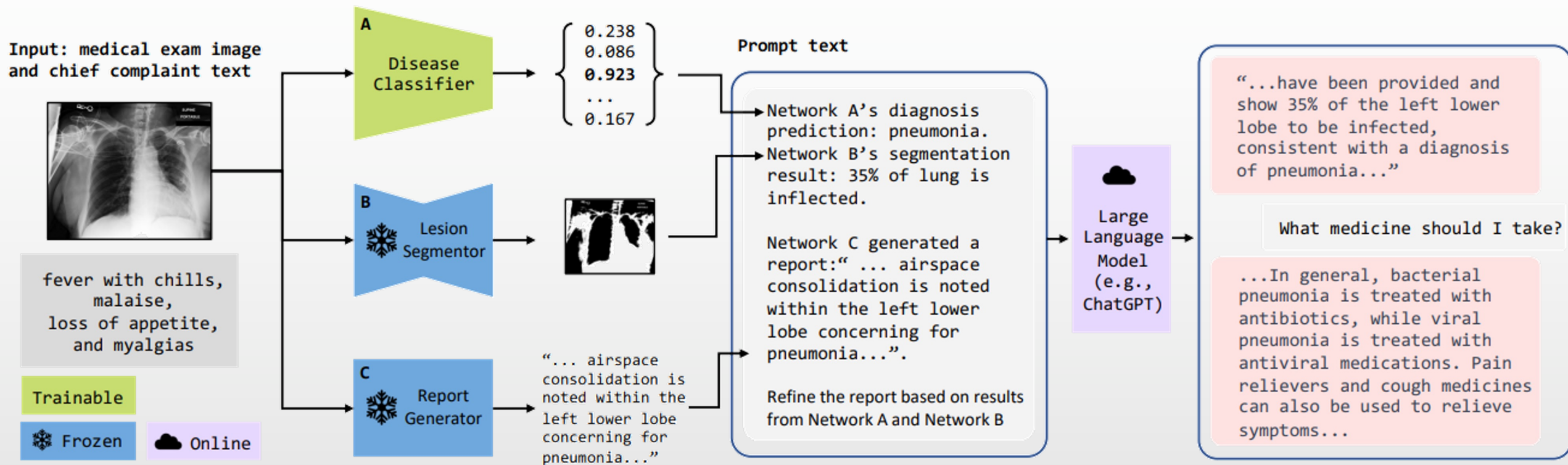
**Benefits, Limits, and Risks of GPT-4
as an AI Chatbot for Medicine**

Peter Lee, Ph.D., Sebastien Bubeck, Ph.D., and Joseph Petro, M.S., M.Eng.

N ENGL J MED 388;13 NEJM.ORG MARCH 30, 2023



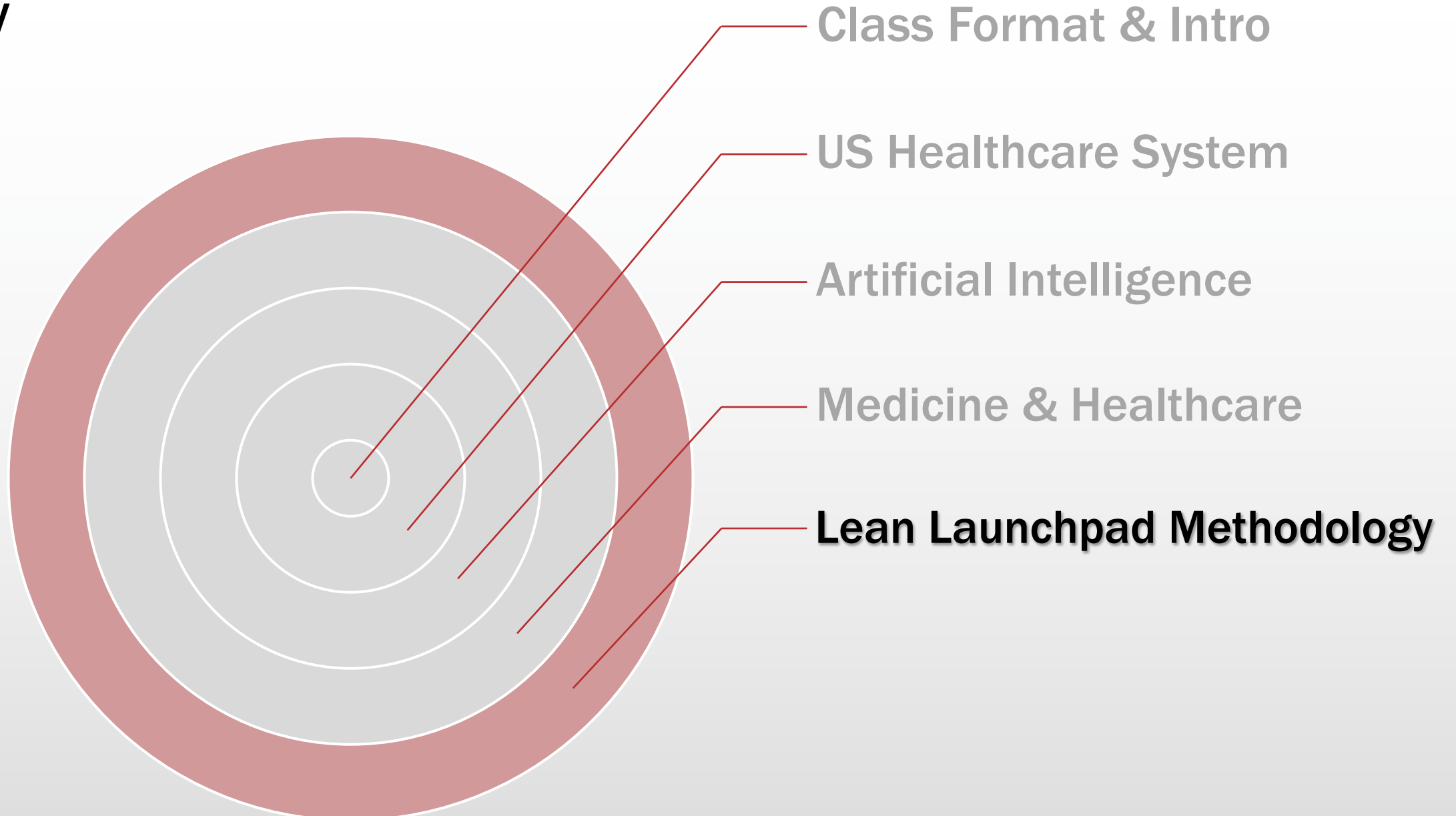
ChatCAD



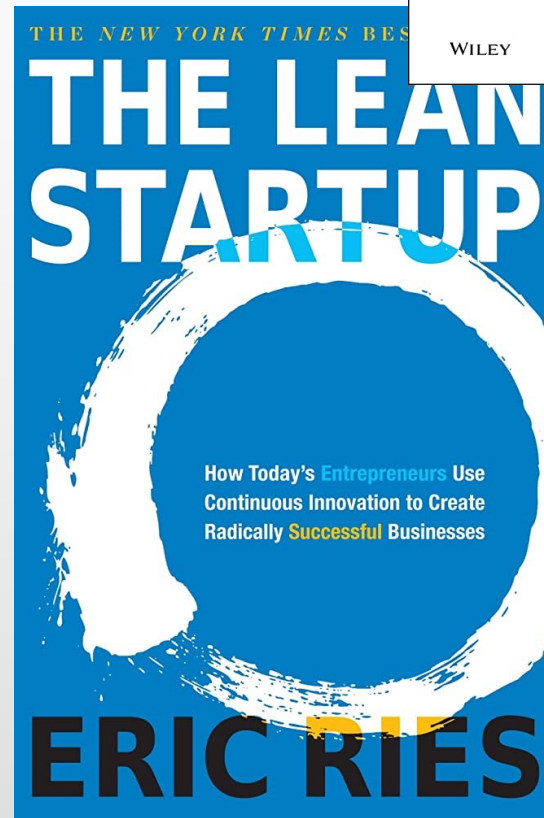
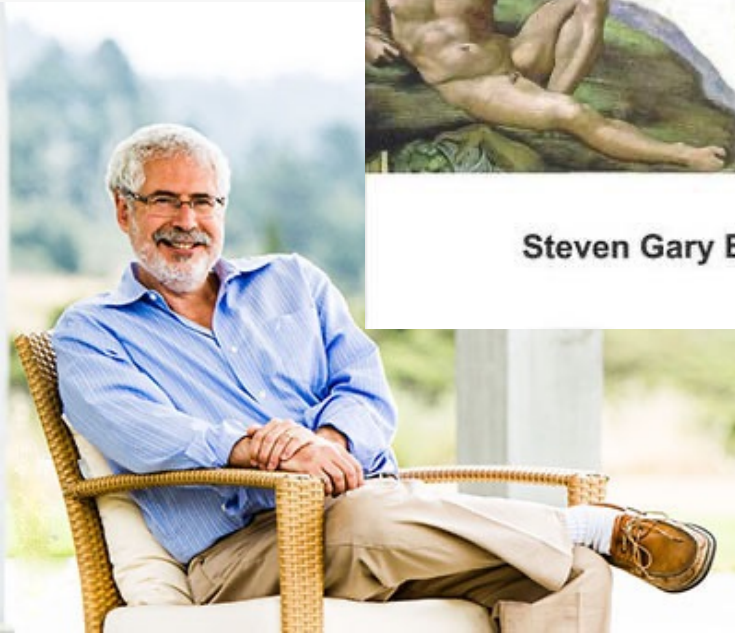
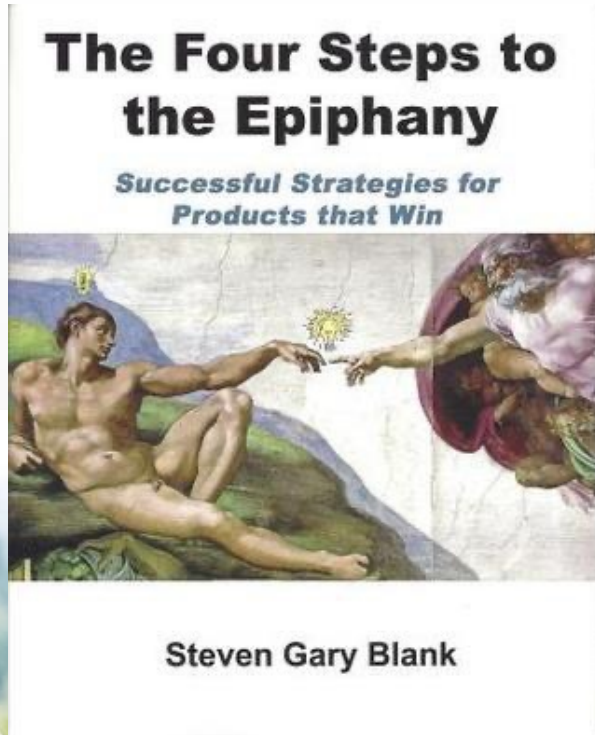
Wang et al. Arxiv 2023



Today



Lean LaunchPad



To be continued next session ...



Thank You!

<https://stanford.edu/~eadeli>



@eadeli

