



Part 2

Lecture 1a How can AI help me?

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Who I am...

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Case: Challenge in Women's Health

AI algorithms in digital mammography have converted single whole digital images of the breast into automatically extracted quantitative, pixel-level variables which are unrecognizable to the human eye.

Ahuja A. The impact of artificial intelligence in medicine on the future role of the physician. Peer J. 2019; 7.



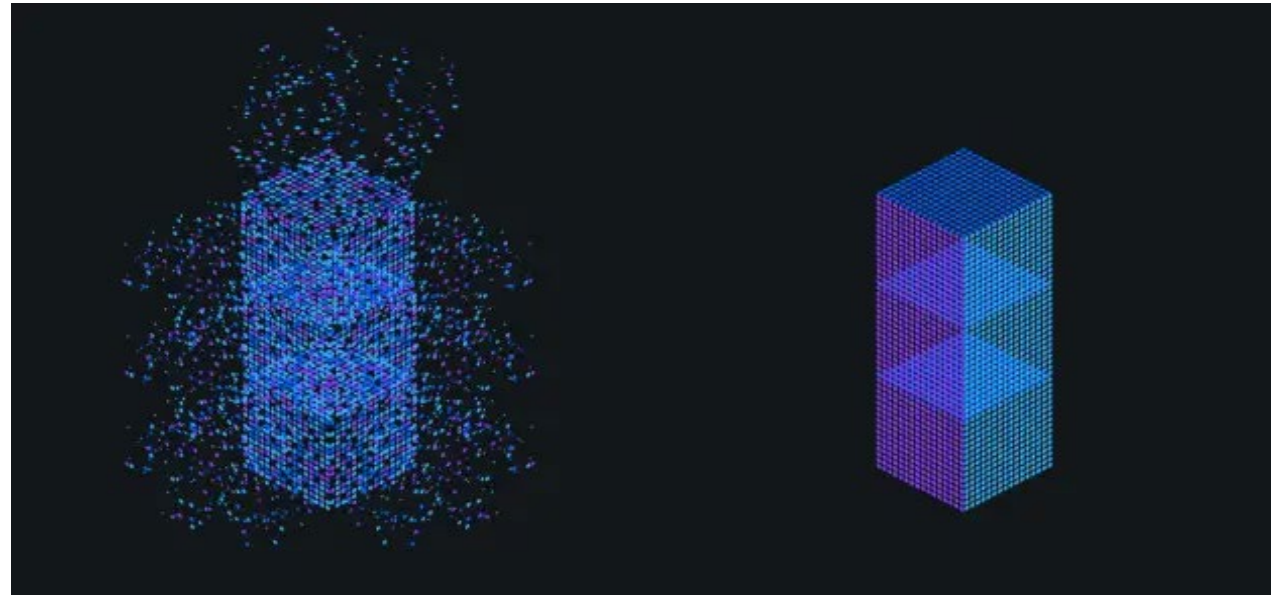
What AI did to help

Computers can cluster these millions of pixel-level variables to identify new imaging features associated with breast cancer, which can be associated with outcome data for training



Patient Outcome

The ultimate promise is that AI can combine these pixel-level variables and associations with patient clinical data, including any known patient risk factors, to develop predictive algorithms that may someday provide equal or better accuracy than human screening mammography



Challenges in the Medical Field

Study on breast cancer detection points out that digital mammography is an imperfect tool with a sensitivity of 91% and a specificity of 86% for detecting breast cancers.

Sometimes false positives lead to significant anxiety, biopsies, and unwarranted surgical removal of tissue.

[https://www.thelancet.com/journals/landig/article/PIIS2589-7500\(20\)30019-4/fulltext](https://www.thelancet.com/journals/landig/article/PIIS2589-7500(20)30019-4/fulltext)

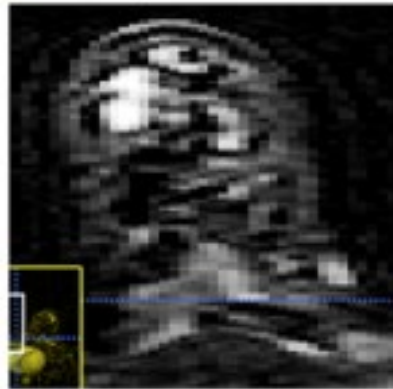


Possible Solution? Radiomics

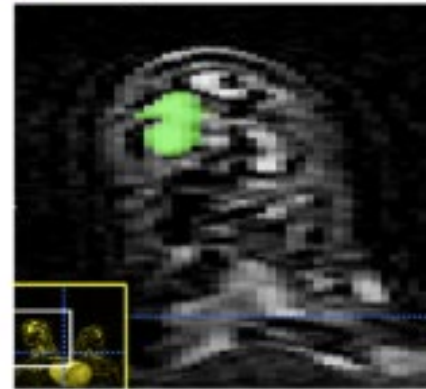
Feature Extraction from medical imaging to detect disease using character-based algorithms

Increase the sensitivity and specificity of breast cancer detection by highlighting key characteristics

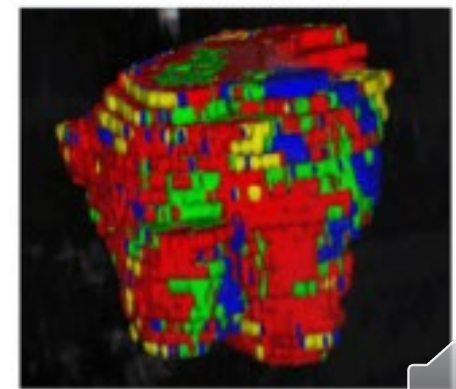
① Image acquisition



② Image segmentation



③ Feature extraction



Study Shows...

Study in 2016 found that physicians spent 27% of their office day on direct clinical face time with their patients and spent 49.2% of their office day on electronic hospital records and desk work.

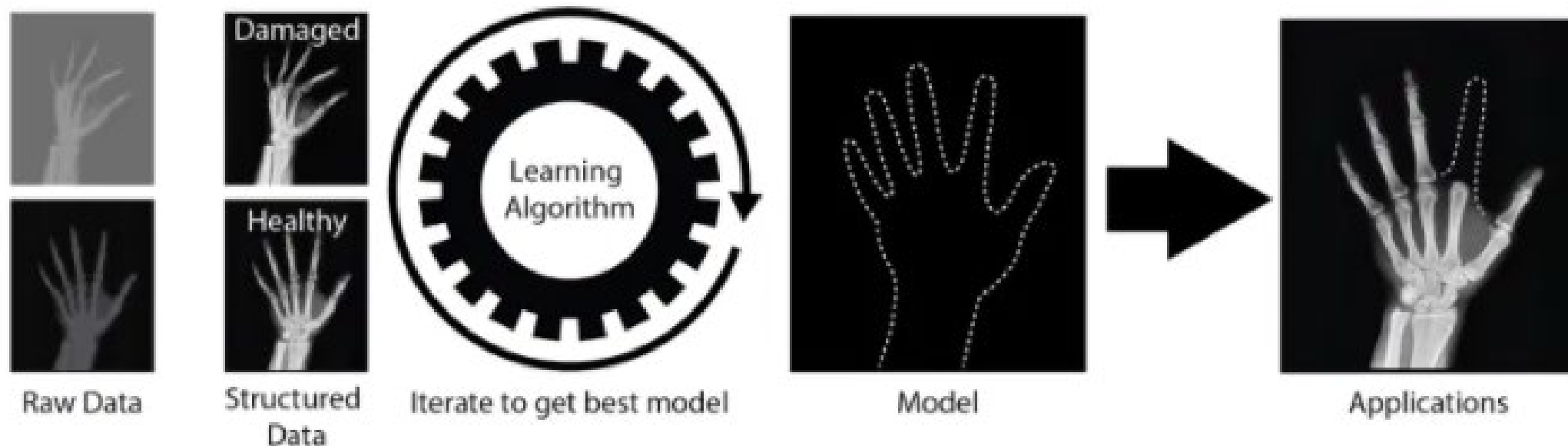
When in the examination room with patients, physicians spent 52.9% of their time on EHR and other work.

Amisha, Malik P, Pathania M, Kumar V. Overview of artificial intelligence in medicine. Journal of Family Medicine and Primary Care. 2019. 8; 7: 2328-2331.



The Challenge

- ❑ It is very time consuming at present for physicians to analyze big data and requires sophisticated analytic tools.
- ❑ One of the factors leading to burnout among physicians is managing the growing amounts of clerical and clinical data



The Rise of EPIC

Novel Electronic Health Record (EHR) software used by many hospital systems

- Physicians must submit orders and consults electronically
- Must type out notes into patient charts opposed to writing on paper
- **Ability to integrate new technologies/software (AI Radiology???)**

The Epic logo is displayed in a large, bold, red, italicized sans-serif font.

How does AI help?

- ☐ Decision making
- ☐ Efficiency
- ☐ Accuracy
- ☐ Precision
- ☐ User needs



Decision Making

- ❑ AI can offer a more definitive answer - sometimes!
- ❑ Physicians often must find information in unstructured medical literature to support care decisions
 - ❑ AI on the other hand can assist physicians by diagnosing diseases using complex algorithms, hundreds of biomarkers, imaging results from millions of patients, aggregated published clinical research, and thousands of physician's notes from EMRs



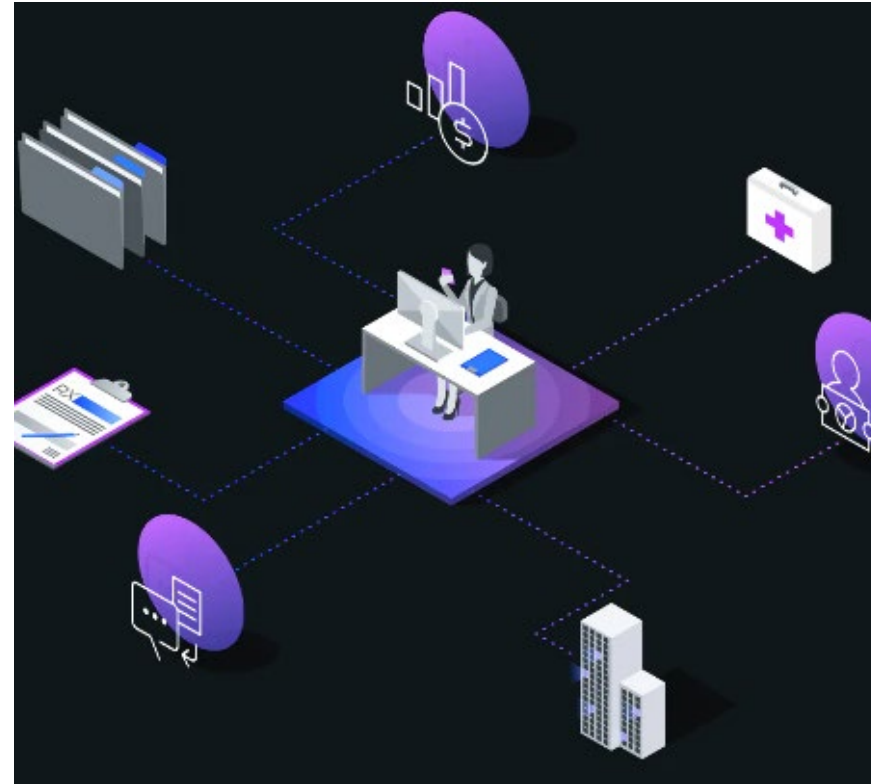
Skin Lesions: Decision making

- ❑ Can outperform dermatologists to detect skin lesions
- ❑ AI systems can learn from successive cases and be exposed to many cases in minutes in comparison to a dermatologist
 - The collective mind



Efficiency

- ❑ Good for automating arduous tasks and can outperform some human tasks
- ❑ Tasks that require human intelligence to complete
 - ❑ Pattern, speech recognition, image analysis and decision making



Efficiency

- ❑ AI can assist physicians in analyzing such big data and help to improve the quality of patient care (Krittanawong, 2018).
- ❑ Coupled with rapid improvements in computer processing, these AI-based systems are already improving the accuracy and efficiency of diagnosis and treatment across various specializations



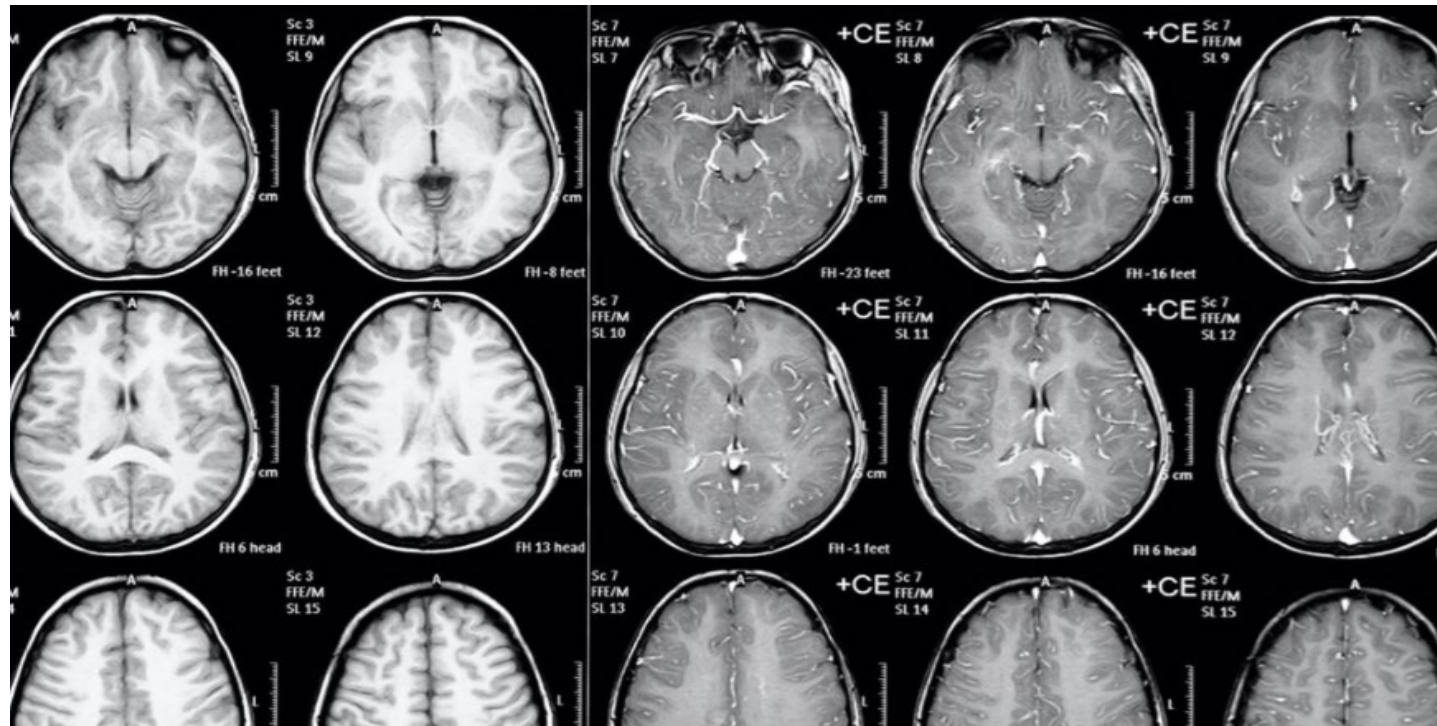
A Tedious Task...

- ❑ Rather than hand-selecting a set of variables such as blood pressure and heart rate, they had the model read patients' entire charts as they unfolded over time up until the point of hospitalization
- ❑ That element both simplifies data entry and enhances performance

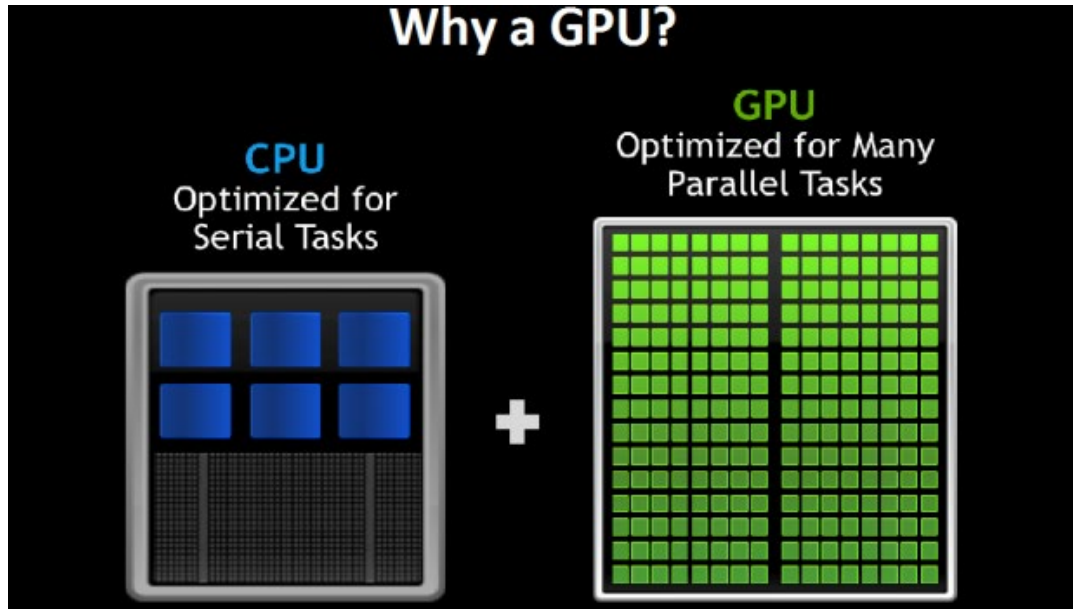


Not just patient data...

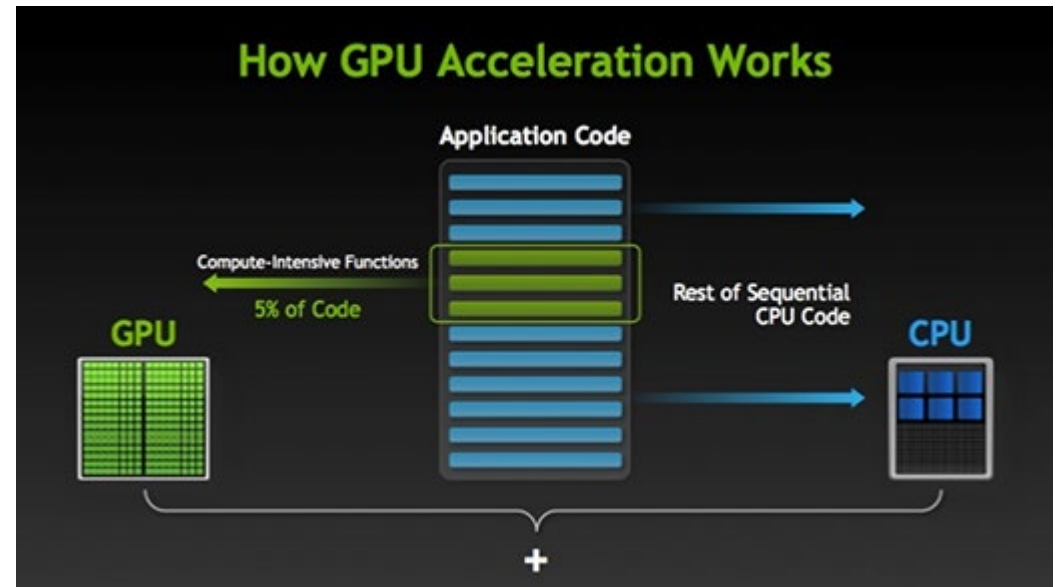
Deep learning algorithms can now be trained with millions of images, in part due to the rapid increase in Graphical Processing Unit (GPU) processing power



What is a GPU you ask?



<https://technofaq.org/posts/2019/12/what-is-gpu-computing/>



Source: <https://nyu-cds.github.io/python-gpu/01-introduction/>

Introducing: BenchSci

Using AI and ML to discover existing biological connections to uncover potential therapeutic targets

Save time from doing...

- Protein assays
- HTS



Efficiency: Mega Drug Search

Searching and developing pharmaceutical agents against a specific disease via clinical trials take years and cost a lot of money.

IBM Watson was put to work to screen existing medications to see if any would prove useful in the treatment of Parkinson's disease which would have taken years to process otherwise.

With the help of AI, we would be able to embrace the new concept of “precision medicine”

*Marras C, Maclagan LC, Cheng Y, Visanji N, Tadrous M, Bronskill SE.
WHAT'S OLD IS NEW: USING ARTIFICIAL INTELLIGENCE TO
ACCELERATE DISCOVERY OF NEW TREATMENTS. Innov Aging.
2019;3(Suppl 1):S16-S17.*

Next up... Accuracy!





End of Lecture 1a

Next up Part 2 Lecture 1b: How can AI help me?

