
Artificial Intelligence

What is Artificial Intelligence

- Three types of Artificial Intelligence
  - Weak AI
  - Strong AI
  - Super Intelligence
- Machine learning provides the foundation for artificial intelligence
- Technique used to train a model using data for predictions
- Three main types of Machine Learning
  - Supervised
  - Unsupervised
  - Reinforcement

Data Quality in Medical Imaging

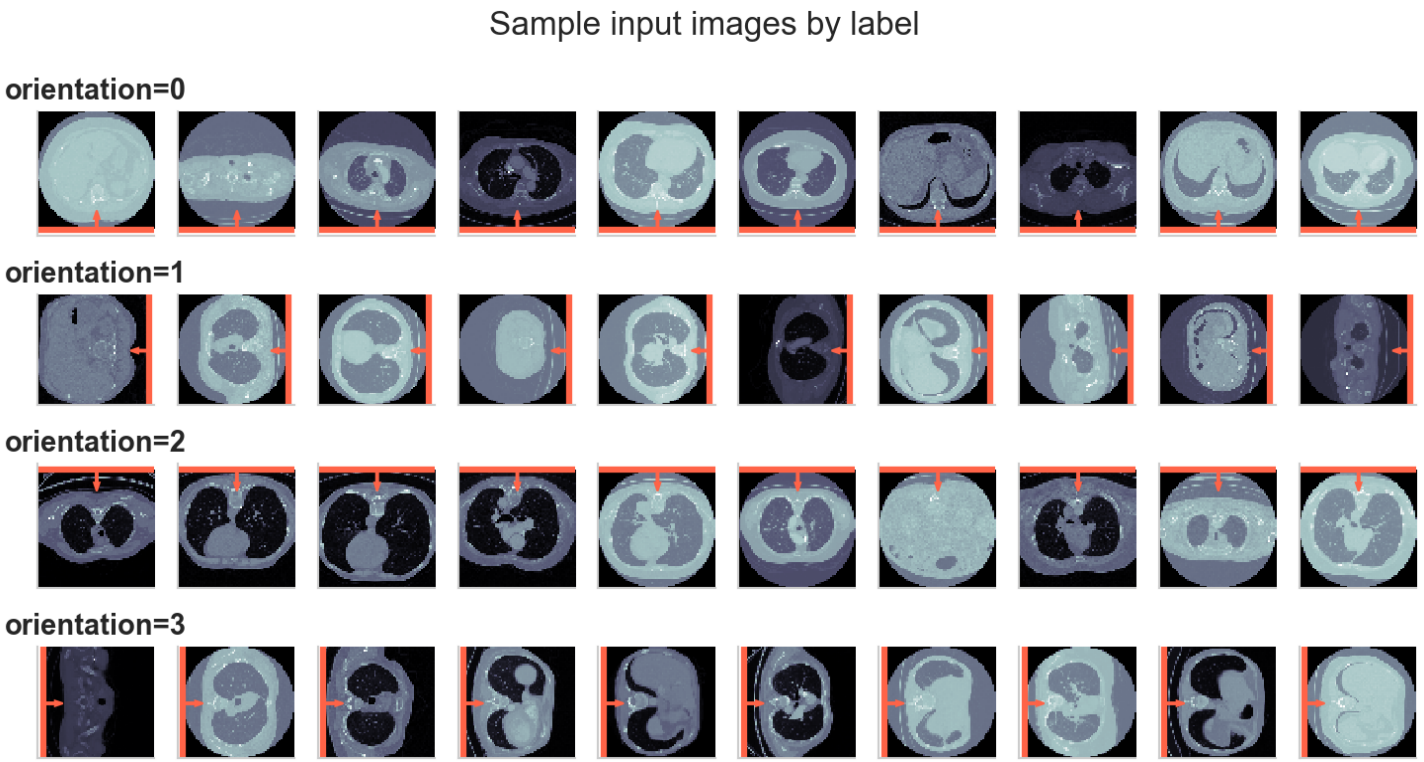
- According to a 2012 report, the annual cost of medical errors in the United States in 2008 alone was $19.5 billion.
- Some of these errors are very hard to prevent without massive overhauls of operational process and organizational culture. But some errors could be easily flagged for human review using artificial intelligence.

Background on CT scans

When a patient has a CT scan taken, a special devices uses X-rays to take measurements from a variety of angles which are then computationally reconstructed into a 3D matrix of intensity values. Each layer of the matrix shows one very thin "slice" of the patient's body.

Problem Statement

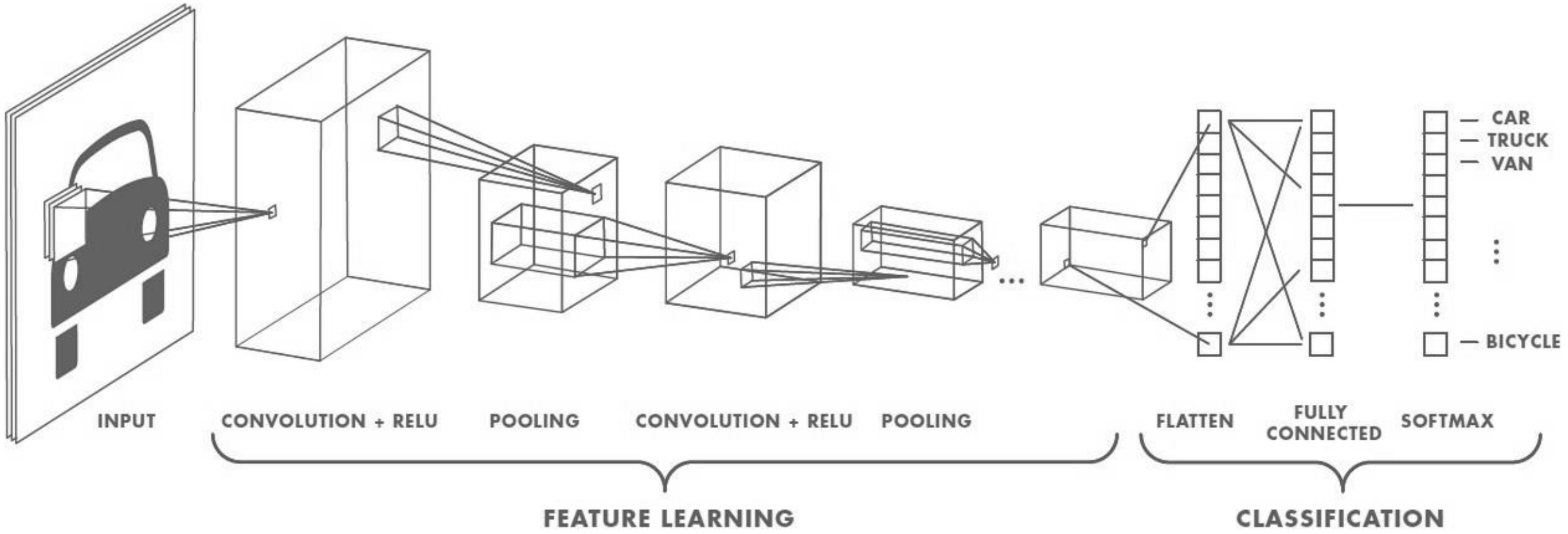
We want to improve the error checking for one single but incredibly important value: a field known as Image Orientation (Patient) which indicates the orientation of the patient's body in the image.



0: Spine at bottom, patient facing up.
1: Spine at right, patient facing left.
2: Spine at top, patient facing down.
3: Spine at left, patient facing right.

INPUT Data Set

- The Lung Image Database Consortium image collection (LIDC-IDRI) consist of diagnostics and lung cancer screening thoracic CT scans.
- Train folder contains images along with a csv of labels and file names.
- Test folder contains images that needed to be labeled.
- Each folder contains 20K images for 40K images total.
- Each image was 64 x 64 pixels and was 156 MB total.



Convolutional Neural Network

Tools and Software

- Visual Studio Code
- SQL Operations Studio
- Microsoft Cognitive Toolkit (CNTK)
- Keras
- Anaconda / Python

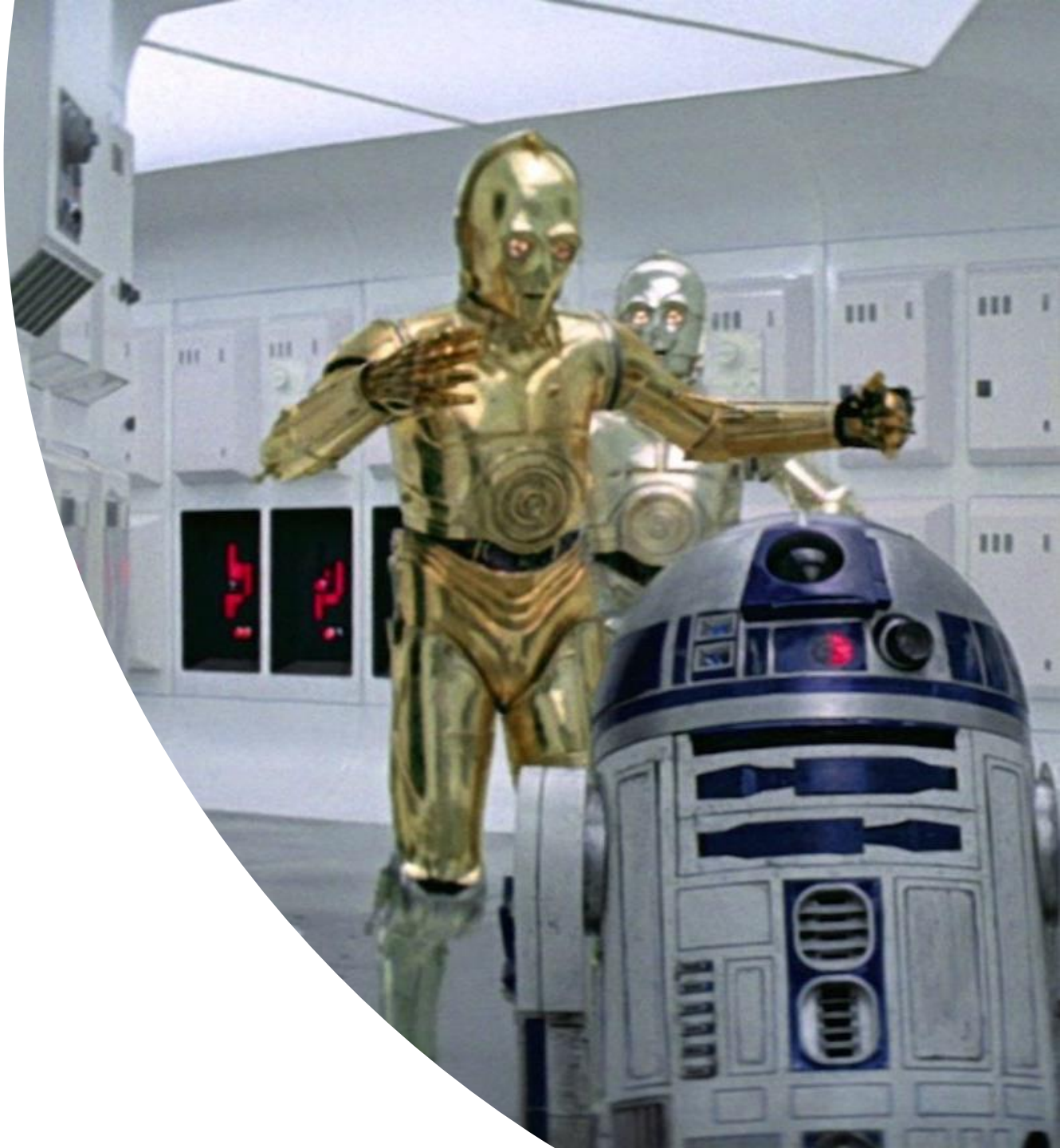
Model Training and Hardware

- Intel i7-7700HQ @ 2.80 GHz / 4 cores
- 40 minutes per epoch
- 100 epochs = 6 hours

Graphics Processing Unit

- Hundreds of CPUs on a chip
- Highly effective multithreading
- NVIDIA GeForce GTX 1070
  - Pascal Architecture with 1,920 cores
- 10 seconds per epoch
- 100 epochs = 16 minutes
- 22.5% increase

- Demo
- Keras with CNTK



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