Week 1 Reflection

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General

Useful knowledge

US healthcare cost is about 3.6 trillions, which is almost equivalent to the market cap of the top 4 tech companies. The estimated healthcare waste cost is between 760-935 billion dollars per year and 1000 preventable deaths per day. Lowering the cost and having a better care is the main purpose of adapting the deep learning frameworks.

Here are a couple of potential applications of using deep learning in healthcare:

1. Diagnosis

- Medical imaging: The Google AI team has developed a CNN model to achieve over 99% AUC to predict a deadly complication of diabetes such as Diabetic Retinopathy.
- Early detection of diseases: With the high mortality rate of about 50% within 5 years of diagnosis, the RNN model of Choi et al. has shown promising result by modelling longitudinal EHRs to accurately predict the onset 6-18 months before the actual diagnosis.
- Triaging: Prioritizing patients based on severity when patients are admitted into ER can help to reduce the mortality rate overall and focus on the patients who need help the most.

2. Outcome prediction or adverse events prediction

- Readmission prediction: Ideally, the conditional expectation of length of time to be re-admitted given patients who already admitted in the past is minimized.

- Length of stay: Deep learning model can help to provide a good estimate of length of stay for both patients and hospital, which in turns can save a lot of time, money and available beds.
- Mortality prediction
- Sepsis prediction

3. Treatment Recommendation

- Drug-drug interaction detection
- Treatment combination recommendation

4. Insurance Application

- Fraud detection
- Cost estimation (premium for care plan based on tier)

5. Drug Discovery and Development

- Molecule property prediction and generation: Traditional drug discovery heavily depends on high throughput screening or wet-lab experiments. Given a molecule structure, deep learning can help to identify the drug candidates or a brand new molecule with desirable properties.
- Clinical trial recruitment: COMPOSE and DeepEnroll are two deep learning models for patient-trial matching that can match the EHR with trial Eligibility Criteria (EC) text given the many-to-many relationships between patients/trial and differences between inclusion and exclusion criteria.

6. Public Health

- Epidemiology models
- Predict covid19 cases at different locations
- Predict hospitalization
- Predict death

Typos

Page 6 line 2: Change from "learn more healthcare data and analytic problems" to "learn more about healthcare data and analytic problems"

Improvements

The book can add one more challenges of US Healthcare as being heavily regulated and any development in the deep learning models may take a substantial amount of time to integrate into the real world healthcare applications.

Chapter 1 summary

Deep learning history

Big *labeled* data sets and parallel computing infrastructure such as GPU finally become available for everyone.

Electronic health records (EHRs)

EHRs capture all patient encounters with rich multi-modal data. EHRs include both structured and unstructured data. Structured data are usually stored in multiple relational databases that contain medical diagnosis codes, lab results, lab orders and medication information. Unstructured data contain clinical notes as text, medical imaging and time-series data.