Realistic knowledge-based waiting times for radiotherapy patients

Addressing the pain of waiting

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The “Netflix Prize”

- $1,000,000 prize for improving recommendation system by 10%
- Open competition for best algorithm to predict ratings based on previous ratings
- Harnessing previous information to make predictions about future information:
  - “Learning from data”
  - “Knowledge-based solutions”
  - “Machine learning”
Waiting...

...when there are other things that can be done.

Patients experience
-- 3 different types of waiting in radiation oncology

1. Treatment planning
   • Waiting at home by the phone
   • Can last days to weeks

2. Daily-fractionated treatments
   • Waiting in the waiting room
   • Can last minutes to hours

3. Consultations with physician
   • Waiting in the waiting room
   • Can last minutes to hours

• Difficult for staff to predict.

• Only rough estimates are given based on experience.

Can we build an algorithm to accurately predict how long a patient is expected to wait?
Solution: Machine learning

• **Goal:** To provide radiotherapy patients with personalized predictions regarding how long they will wait for the provision of care in the Department of Radiation Oncology at the MUHC.

• **How:** Learn data from previous patients to make predictions for future patients.

• **ML is trending!** Major companies are already working on this kind of learning process.
How does ML work?

Basic steps

1. Define the problem
   • Not knowing how long to wait.

2. Define your dataset
   • Putting in historical patient information such as:
     • Time of the appointment, doctor, diagnosis, etc.
     • Getting out the duration of an appointment to infer a waiting estimate.

3. Choosing the right algorithm
   • There is no perfect model; only a model that is good enough.

4. Validate your algorithm
   • Divide your existing dataset into training and testing sets.
   • Cross-validate.
Results
Results
Residual histogram

--- Mean error: 0.25 mins
--- Median error: 0.5 mins
--- Standard deviation: ~8 mins
Conclusions

• Machine learning can be successfully applied to waiting times in Radiation Oncology.

• Future work
  • Communicate waiting times to patients
  • An app is currently in development

• This can have a significant impact on patient lives!
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