Accessing OER: Challenges and Pointers

John Shawe-Taylor
Department of Computer Science
UCL
The Example of Placing Advertisements

- Web pages often contain ads that are targeted at the user
- Aspects of ad that affect placement:
  - Style of presentation
  - Topic of ad
- Aspects of user that affect placement:
  - Interests of the user
  - Likes/dislikes of different styles
  - Current search/content that he/she is viewing
  - Time of day
Algorithms for Placing Ads

- Challenge to learn about the user’s preferences while getting as many clicks as possible
- Reduces to trading exploitation (optimise based on current knowledge) versus exploration (try to find out more about the user)
- So-called ‘bandit algorithms’ achieve this trade-off:
  - Simple bandits model a set of slot (1-armed bandit) machines
  - Associative bandits model response probability as a function of a set of features
- These algorithms (and other related ones) are implemented at scale in many ad placement systems and are very effective
OER are more challenging

• Dimensions that will affect if a piece of content is useful/relevant:
  • Style of presentation
  • Topic
  • Assumed background knowledge
  • Specific knowledge/insights that content aims to convey

• Content needs to mapped into the identified dimensions
  • This will require extraction of information from multi-modal data, ideally at individual section level so that specific sections can be indexed
  • Will also need to link different ways of expressing the same ideas: different words, expressions, notation, etc.
Need to know users better

• learn about their preferences for style etc,
• model their background knowledge in a fine grained manner along the identified dimensions
• interact in order to understand their current interest/goal, again in the identified dimensions
Need longer sequences of interactions

• Decisions about ad placement are made independently
• A learning experience needs a sequence of recommendations that take a user from their current state of knowledge to the identified goal
• Plans need to adjust as more is learned about the user and the effects of earlier recommendations are discerned
• Exploitation and exploration again involved, but more complex sequences of actions required
Pointers to solutions (reasons for optimism)

• The revolution in AI is driven by machine learning approaches that do not attempt to reduce to a logical taxomony.

• It rather uses patterns in the data to link them and identify latent dimensions, examples:
  • able to link company websites with a classification of company functions despite using different terminology.
  • remarkable success in predicting an individual’s sequence of jobs from their CV.
Complex interactions

- Further evidence of success in implementing sequences of interactions is given by AlphaGo:
  - Outplayed the world champion in a game that was widely viewed as a major AI challenge
  - Requires planning of long sequences of moves
  - Uses a combination of Deep Learning to identify patterns in the board positions and Reinforcement Learning to plan actions
Conclusions

• Systems that prioritise content exist (eg for ads) that are effective at scale
• Enabling effective access to OER requires significant enhancements in
  • Modelling of the content
  • Modelling users’ interests and state of knowledge
  • Learning more complex sequences of actions
• Nonetheless there are examples of similar challenges being tackled effectively in all of these aspects