Schedule for Week 2 of SI 701: Information Theory and Artificial Intelligence

Meghana & Linfeng

September 14, 2015

The goal is that we, as tomorrow's "PhDs in Information", should know enough about information theory and its origins to converse about it in casual situations or interviews.

1 Part 1: while Paul is in the room

For the first 80 minutes, Paul will be around.

1.1 Opening: summary and stories (30 min)

1.1.1 Summarize the readings

1.1.2 Write/talk about the two things that you found most interesting in this week's readings (10-15 min)

Get people to talk.

1.1.3 What's new: (check list)

- Entropy: measure for information.
  - A measure of information with units as 'bits'.
  - More technical details comes after the break.
- Diagram of Information Source, Transmitter, Noise Source, Receiver, Destination;
  - Compression Lossy vs Lossless
    1. Summary vs Excerpt
    2. Diff (for storage and version control)
- Further discussion on applications/understandings of Entropy (Need to post these questions and lead the discussion)

  - When a message is not yet random, it contains redundancy.
    * Compression reaches zero redundancy when the message is truly random;
    * Encryption achieves the stage of "undecipherable" if the message is truly random.
    * Then, does lossless compression reach a fully-lossy consequence when pushing it to the limit?
  - Underdog wins
  - Redundancy does not increase or decrease entropy

- Turing test as a standard for Artificial Intelligence (1950): **Can machines think?**

  1. Describe the Turing machine the universal Turing machine.
  2. Turing continued to ask What can a machine not do?
  3. What is the Turing Test?
  4. In *The Most Human Human*, how does Brian Christian relate the Turing test to entropy?

1.2 Paul's lecture (15 minutes)

Paul agreed to cover:

- compression
- Comparison among: completing texts (texting on iPhone) and generating text (Turing test)

1.3 Nicole's lecture + connecting with future materials (15 minutes)

- Modern communication theory's critique of Shannon's information theory.

2 Part 2: second 1.5 hours

Resume after a 10 minute break.

2.1 On definition of Entropy (20min)

- Foundation: discrete probability distribution and probability density function;

Definition 2.1. For discrete distribution,

$$H(\tilde{x}) = -\sum p_i \log_2 p_i$$

2.1.1 About the probability distribution:

When calculating the entropy of a random variable, we only use "true probability".

2.2 Game on word prediction (20 min)

Would a human being be better at word prediction? Let's play a version of the Shannon game.

Stage 1 (**Setup**) Pair up into groups of 2;

Stage 2 (**Seeding**) Person 1 comes up with a sentence. They then type the first word into their smartphone;

Stage 3 (**Prediction**) We now compare between the following three: the smartphone's prediction of the next word; the person 2 (of the pair) prediction by "guessing"; and the actual word that person 1 had in mind. Repeat this for the whole sentence.

Stage 4 (**Discussion**) Reflect on share your experiences.

2.3 Discussion

- How does text prediction affect our behaviour/communication patterns? Moreover, text prediction perpetuates the biases contained in the training data. For example, UN Women had a famous ad campaign showing actual autocomplete results on entering the keywords "women should", "women can't", "women need to be" in Google's search box. Results: "women need to be put in their place", "women can't drive", "women should stay at home". What are the implications of such algorithms?
- What makes computers a possible channel of artificial intelligence? [1]
- Shall a system/algorithm/mechanism that follows **(fixed) rules** be counted as intelligence?
- What would be the problem if computers turned out to be intelligent?
- Summarize the Ashley Madison case and ask for people's opinions.
- How would you connect this week's readings to those from last week?

2.4 Closing thoughts: did anyone change their mind about what they found most interesting in this week's readings?

2.5 Extras, if we have too much time left

- Live chat with a bot! www.jabberwacky.com

[1] Due to the fact that computers as binary calculators can practice arbitrary algorithm, as algorithms could all be decomposed into binary relations governed by conditions and coconditions ("if" statement"), as well as logic connectives ("and, or, not").