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

Meghana & Linfeng

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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 What's new: theory and concepts

- Diagram of Information Source, Transmitter, Noise Source, Receiver, Destination;
- Entropy:
  - Foundation: discrete probability distribution and probability density function;
  - definition (for discrete case).
- Turing test as an (old) standard for Artificial Intelligence

1.1.2 Interesting stories from bibliographical reading (10-15 min)

- Inspire, and have people to talk about it. (Rephrase the question)

(The goal is to get people as tomorrow's "PhD in Information" know about something to gossip while talking about how information theory came about.)

1.2 Use extreme cases to push understanding to a limit

Example 1 (An extreme case to understand reduency and compression and "randomness".)**.** When a message is not yet totally random, it contains redundancy.

More examples to come

More examples to be included.

1.3 Paul's lecturing (15 minutes)

Paul agreed to cover:

- Connection among compression, redundancy and Entropy?
- Comparison among: completing texts (texting on iPhone) and generating text (Turing test)

1.4 Nicole's lecturing + connecting with future materials (15 minutes)

- Communication is two-way "flow of information"
- Relate the whole reading to:
  - Common ground;
  - Classification
  - Prospect theory
  - .....

2 Part 2: second 1.5 hours

Well, given a minimum of 10 minutes break in between, 80 minutes is the target here.

2.1 Game: demonstrating the diagram in a concrete setting (25 minutes)

For designing the game, we may want to control for the following factors independently (i.e. introducing one factor at a time). Each game shall take around 15 minutes or so;

- Compression: from sentence to graph, and then back to sentence;
- Noise through the channel: plot a message, and have someone to doodle on it (noise), and have the receiver decipher.

The goal is to mimic a controlled environment.

2.1.1 Potential things to add to the Game

- Measure of "entropy" per message. $\Longrightarrow$ This would need a more carefully defined set of "potential messages", on top of which we could derive the background distribution/density-function
- Demonstrate how noise would affect entropy?

2.2 On definition of Entropy

Definition 2.1. For discrete distribution,

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

2.2.1 About the probability distribution:

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

2.2.2 Measure of surprisal? One that is defined over subjectively assigned information.

Surprisal defined on Wiki has a functional form that resembles entropy. For the coin-flipping case, the value is exactly the same. I doubt if surprisal would really serve the need for comparison.