

Solving language and solving AI - a tour

What is language?

Language is mainly thought of as a medium of communication. Language is also a means of self realization. Ideas have an independent existence, but we realize and understand ideas via language. Thus, manifestation of ideas is language based.

Problems in Artificial Intelligence

Any intelligent system requires the following abilities:

1. Sensing and Recognition - Being able to detect the underlying values of the raw signals that are received
2. Understanding and Extrapolation - Being able to generalize information and correlate it with past experiences, to extract a more general and abstract idea
3. Communication and Dialog - Being able to interact with other intelligent systems in order to share knowledge
4. Strategy and Hypothesis Testing - Being able to come up with strategies when faced with a new problem, and test the correctness of any hypothesis that is being worked upon, self correct accordingly and improvise

Sensing and Recognition

Humans do this in various settings - through the five senses of sight, touch, taste, smell and sounding. The brain manipulates these signals enabling us to infer things like shape, colour, distance, phones etc. implicitly. A universal, rich representation of what we perceive is formed. For AI, these signals are inevitably streams of bits. To form any meaningful representation from these, the primary task is to know where the stream for one idea ends and another starts i.e. where to draw the line,

Natural language is recursive, thus allowing us to think in terms of finite linguistic entities. Phones are diverse and independent, and are usually part of continuous discourse. Script, on the other hand has discrete entities that we have to decipher. Thus, language requires us to perform segmentation, which we do with the help of the context that we have.

Understanding and Extrapolation

It is important to distinguish between sensing and understanding. Words form the content of sentences, which we can sense. But these do not make any sense unless we understand the underlying structure - the order that the words occur in.

All word-entity interactions have universally acceptable representations, meaning these are constant across different modes. This enables us to identify things even when we haven't come across them before in that form, but have seen another object of the same class. So, these representations must be rich enough to correlate closely related objects and not just assign arbitrary numbers in order to list all objects.

To understand what we see, we observe and recognize things, and construct relations based on experience. Understanding something requires more than just the information it contains, we also need past knowledge and context. Internalizing an observation allows us to infer from the past, correlate it to the present and predict the future.

To understand language, we must understand the representations of ideas in that language. We need to infer meaning from the phrases of a sentence to attempt to complete the sentences by predicting the future phrases i.e. have a theory of understanding.

Dialog and Communication

Dialog and communication is important in order to share knowledge, divide tasks and cooperate in order to effectively solve problems. If machines are allowed to communicate, they need to form compact representations to communicate effectively. These representations must include features such as deixis and an external context. These representations should also be minimal, meaning the communication channel shouldn't be too large but not so much so that communication becomes highly ambiguous. Finally, there must be a shared idea of the world even when there isn't an immediate context.

Natural language encodes a large amount of information in a relatively compact channel via the combinatoriality of words, and this information requires social context and worldly knowledge in order to be fully understood.

Thus we can say that natural language inherently solves many problems in AI in one way or another, and if we can build intelligence for natural language, we can probe at solutions to more generalized problems as well.