Geometry of Intelligence

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Getting machines to reason

- On-line education revolutionizes the educational process
- But, can we teach machines to reason?
- This would change the way to learn and/or teach
- We are on our way to build systems that can develop cause-consequence graphs, semantic question-answer system etc

Semantics

- Semantics – a mapping from one domain to another we can understand better
- Denotation semantics – a chair as a concept, not a particular chair
- Distributional semantics – Firth: We know words by the company they keep
- What word comes after the?
- How about Costa?

Language model

- Map words into vectors of sufficiently large dimensions
- Semantically close concepts to be mapped to vectors that are geometrically close (angle between vectors should be small)
- The number of meaningfull combinations of N-grams of words large but finite
- Turns out few hundred dimensions enough

The method

- The algorithm: words appearing in texts together need to appear close in the embedding vector space
- Need huge corpora of texts to train the system
- But, once it is done, use the same vector for each word no matter what the context

Linearity and convergence

- Take vectors king – man + woman. The closest to that is the vector for queen.
- The word bank has many meanings. Adding more vectors (words) clarifies what do we mean
- Bank shot, bank account, sperm bank
- Adding more vectors move into smaller volume of the vector space
- bank -> bank account -> Internet bank account

Q-A Systems

- Belgrade is the capital of Serbia
- Belgrade is the capital of Serbia – Belgrade =
- is the capital of Serbia
- What + is the capital of Serbia?
- Answer: Belgrade is the capital of Serbia

Smaller languages?

- Crucial to develop AI linguistic models not just for English and major languages but for smaller languages as well
- Models for Serbian developed in Croatia and Slovenia, not here!
- Perhaps we should care?
- The Group for General Artificial Intelligence created at RAF develops new approach to GAI