Machine Translation: Future Directions

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Potential Directions

- Representation
- Unsupervised Learning
- Hybrid MT
- Semantics-based MT
Knowledge Representation

One of central concepts in AI
Representation

Knowledge Representation
One of central concepts in AI

Translation Representation
- word pairs $\rightarrow$ word-based SMT
- bilingual phrases $\rightarrow$ phrase-based SMT
- ITG rules $\rightarrow$ ITG-based SMT
- Chiang-style rules $\rightarrow$ Hierarchical phrase-based SMT
- various tree-based rules $\rightarrow$ tree-based SMT
Representation: What’s next

- distributed representations by deep learning
- semantics-based representation
- graph-based representation
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Tradeoff
- computational tractability
- expressive capacity
Unsupervised Learning

- EM for word alignment: big success
- EM or generative models for phrase/grammar induction: failure or moderate success
- unsupervised discriminative learning: an exciting new direction (Xiao et al., 2012; Xiao and Xiong 2013)
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Future Unsupervised Learning for MT

- Learning from big and unstructured data
- Learning tailored for new translation representations
- Never-ending learning
Hybrid MT

Why hybrid?

No single approach or paradigm to MT is capable of handling all language phenomena and divergences.
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Hybrid MT

- Multiple paradigms: complementary to each other
  - rule-based MT
  - example-based MT
  - statistical MT
- Multiple components: one component per language task
Semantics-based SMT

Multi-layer view of semantics-based SMT

- **Lexical semantics**
  - word sense
  - polysemy/synonym
  - ...

- **Structural semantics**
  - shallow semantics
  - deep semantics / logic form
  - ...

- **Discourse semantics**
  - cohesion / coherence (Xiong et al., 2013a, 2013b, 2013c)
  - discourse relations
  - ...


