CS 4824/ECE 4424: Attention

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Attention

- **Key idea**: highlight important parts of the inputs

- Mechanism for alignment in machine translation, image captioning, etc.

- Attention in machine translation: align each output word with relevant input words by computing a softmax of the inputs
Attention

- Attention in Computer Vision
  - 2014: Attention used to highlight important parts of an image that contribute to a desired output

- Attention in NLP
  - 2015: machine translation
  - 2017: Language modeling with Transformer networks
Sequence Modeling

- **Challenges with RNNs**
  - Long range dependencies
  - Gradient vanishing (and explosion)
  - Large # of training steps
  - Recurrence prevents parallel computation

- **Transformer Networks**
  - Facilitate long range dependencies
  - No gradient vanishing (and explosion)
  - Fewer training steps
  - No recurrence that facilitate parallel computation

vs
Attention Mechanism

- Mimics the retrieval of a value $v_i$ for a query $q$ based on a key $k_i$ in database

- Retrieval:

\[
\text{attention}(q, k, v) = \sum_i \text{similarity}(q, k_i) \times v_i
\]