

Unsupervised Word Translation

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Can we train a model to translate a language we know nothing about?

Yes we can!

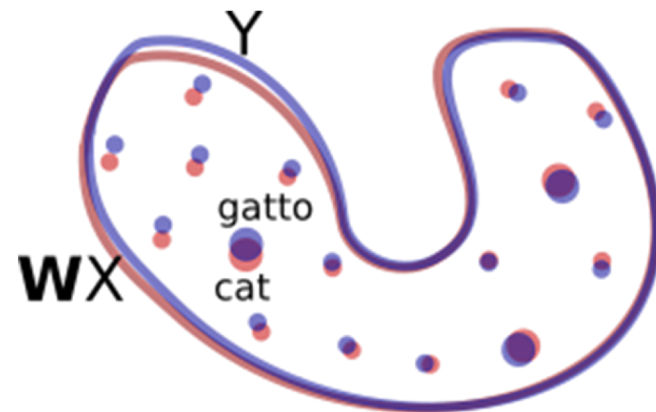
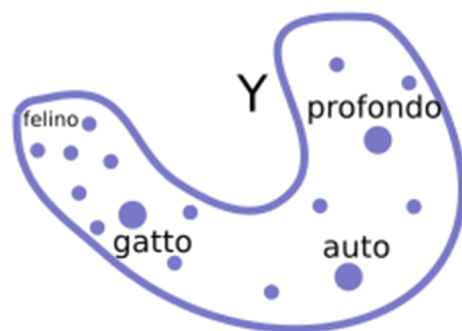
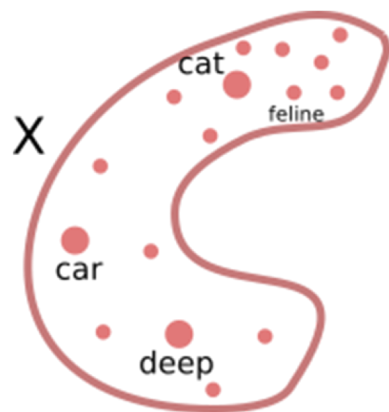
- Near the end of 2017, FAIR (Facebook AI Research) published a model called MUSE (**M**ultilingual **U**n**S**upervised word **E**mbeddings)
- MUSE can learn to translate between languages without any cross-lingual information!
- Achieves state of the art accuracy on hundreds of languages, even coming close to or surpassing supervised models!

Word Embeddings

- Word embeddings are models that map every word in a language to a fixed-size vector
- The idea is to map words in such a way that the resulting vector space somehow captures something about the relationships between words
- Most famous example: Word2Vec (Mikolov 2013)
- King – Man + Woman = Queen

MUSE

- We start with a fixed set of word embeddings in each language, typically learned from a large corpus of text
- Given target vectors Y and source vectors X , we want to learn a mapping $Y = XW$ between the two spaces
- We want to do this in such a way that the *distribution* of vectors in each of the two languages is the same



GANs

- MUSE does this by using a GAN (**Generative Adversarial Network**)
- We train a *discriminator* to try to tell whether two vectors are from the same language, and a *generator* to map the vectors from one language into each other
- The discriminator and the generator are *adversaries* – they each train to try to beat the other

MUSE

- MUSE has been incredibly successful, and set a new standard for word translation
- Many papers have been published following up on MUSE's techniques, but there are still open problems in the area
- One of the most important is to improve the performance on highly dissimilar languages and low-resource languages
- This is an area that could be an excellent opportunity for a research project

European Languages	
En-Es	81.7
Es-En	83.3
En-Fr	82.3
Fr-En	82.1
En-De	74.0
De-En	72.2
En-Ru	44.0
Ru-En	59.1
En-It	76.9
It-En	76.7
Non-European Languages	
En-Fa	*
Fa-En	*
En-Hi	*
Hi-En	*
En-Bn	*
Bn-En	*
En-Ar	35.3
Ar-En	49.7
En-He	41.6
He-En	52.6
En-Zh	32.5
Zh-En	31.4
En-Ja	*
Ja-En	4.2
En-Vi	*
Vi-En	*
En-Id	67.8
Id-En	66.6

*Failed to converge