



deeplearning.ai

# NLP and Word Embeddings

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## Properties of word embeddings

# Analogies

	Man (5391)	Woman (9853)	King (4914)	Queen (7157)	Apple (456)	Orange (6257)
Gender	-1	1	-0.95	0.97	0.00	0.01
Royal	0.01	0.02	0.93	0.95	-0.01	0.00
Age	0.03	0.02	0.70	0.69	0.03	-0.02
Food	0.09	0.01	0.02	0.01	0.95	0.97

$$\underbrace{e_{\text{Man}}}_{5391} - \underbrace{e_{\text{Woman}}}_{9853} \approx \underbrace{e_{\text{King}}}_{4914} - \underbrace{e_{\text{Queen}}}_{7157}$$

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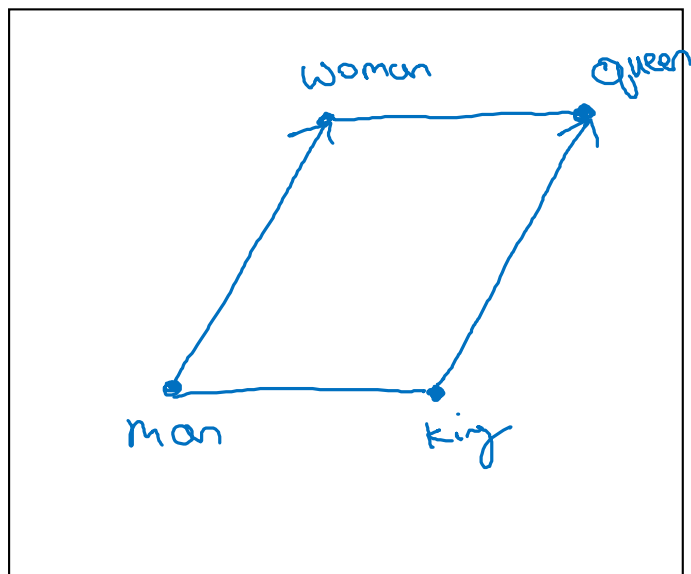
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[Mikolov et. al., 2013, Linguistic regularities in continuous space word representations]

Andrew Ng

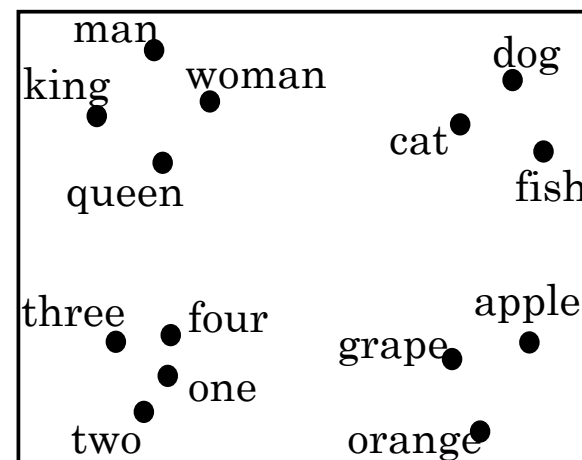
# Analogies using word vectors



300 D

Find word  $w$ :  $\arg \max_w$

300D  $\rightarrow$  20  
↑



t-SNE

$$e_{\text{man}} - e_{\text{woman}} \approx e_{\text{king}} - e_w$$

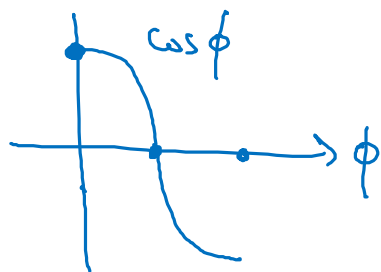
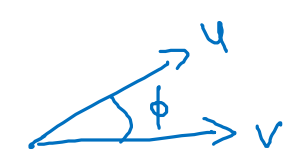
$$\text{Sim}(e_w, e_{\text{king}} - e_{\text{man}} + e_{\text{woman}})$$

30 - 75%

# Cosine similarity

$$\rightarrow \boxed{\text{sim}(e_w, e_{\text{king}} - e_{\text{man}} + e_{\text{woman}})}$$

$$\text{sim}(u, v) = \frac{u^T v}{\|u\|_2 \|v\|_2}$$



$$\|u - v\|^2$$

Man:Woman as Boy:Girl

Ottawa:Canada as Nairobi:Kenya

Big:Bigger as Tall:Taller

Yen:Japan as Ruble:Russia