Conditional Generators of Words Definitions

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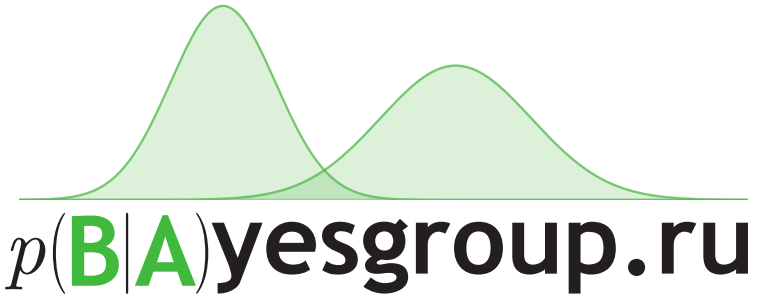
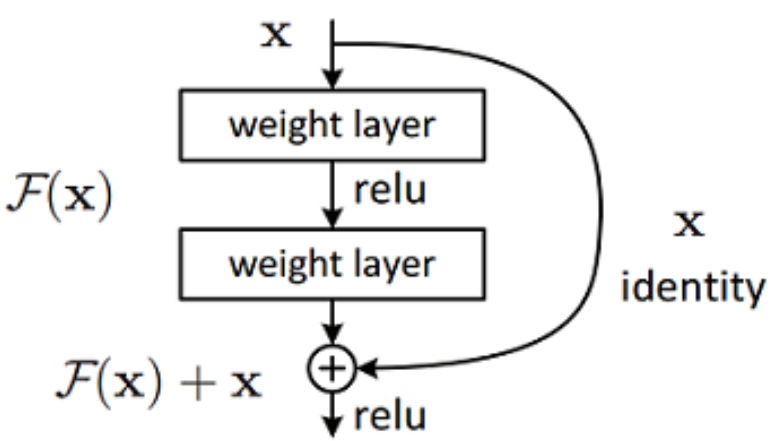
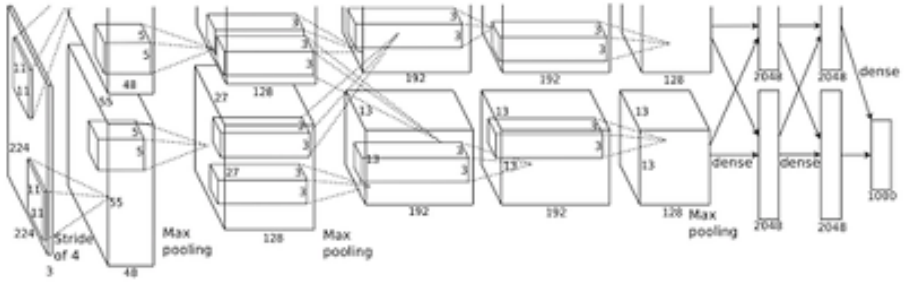
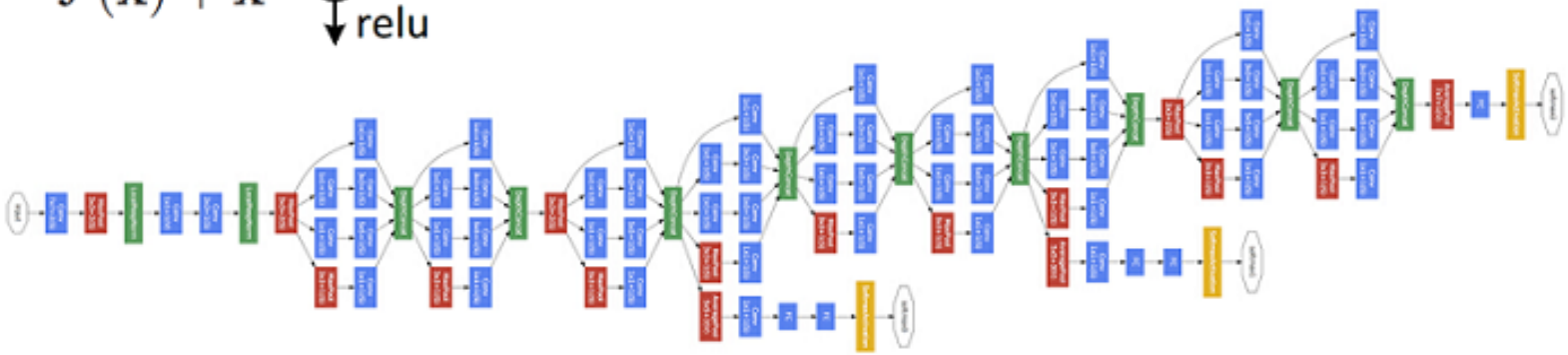
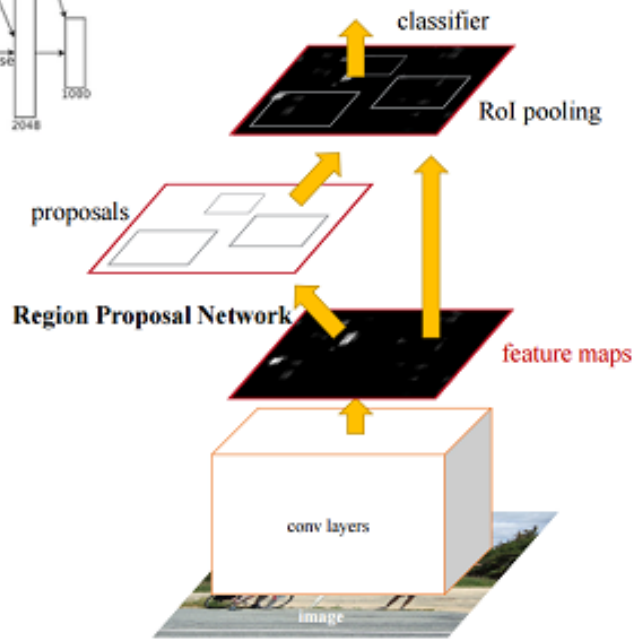


Introduction









Data: Oxford dictionaries

cat[1]

NOUN

1 A small domesticated carnivorous mammal with soft fur, a short snout, and retractable claws. It is widely kept as a pet or for catching mice, and many breeds have been developed.

> Felis catus, family Felidae (the cat family); it was probably domesticated in ancient Egypt from the local race of wildcat. The cat family also includes the ocelot, serval, margay, lynx, and the big cats

– Example sentences

'Various species have been used as models of human asthma, including guinea pigs, mice, rats, cats, and dogs.'

Related Work: definition modeling

- w* - word being defined
- D = {w_1, …, w_T} - definition

$$p(D|w^*) = \prod_{t=1}^{T} p(w_t|w_{i<t}, w^*)$$

Noraset et al. Definition modeling: Learning to define word embeddings in natural language, AAAI 2017

Definition modeling: types of conditioning

- Seed (S) - append w* to definition sequence: D = {w*, w_1, …, w_T} (Sutskever et al. 2011)
- Input (I) – $h_t = g([v^*; v_t], h_{t-1})$
- (CH) - capture sub-word information (Kim et al. 2016)

Noraset et al. Definition modeling: Learning to define word embeddings in natural language, AAAI 2017

Proposed generative model

- w* - word being defined
- D = {w_1, …, w_T} – definition
- C = {c_1, …, c_M } – context (e.g. example of word usage)

$$p(D|w^*, C) = \prod_{t=1}^{T} p(w_t|w_{i<t}, w^*, C)$$

Adaptive Skip-gram based (Input Adaptive)

$$h_t = g([v^*; v_t], h_{t-1})$$

$$v^* = disambiguation(w^*|C)$$

Bartunov et al. Breaking sticks and ambiguities with adaptive skip-gram. In AISTATS 2016

Attention based (Input Attention)

$$h_t = g([a^*; v_t], h_{t-1})$$

$$a = v^* \odot mask$$

$$mask = \sigma(W \frac{\sum_{i=1}^{M} ANN(c_i)}{M} + b)$$

Experiments: definitions generation

Word	Context	Definition
star	she got star treatment	a person who is very important
star	bright star in the sky	a small circle of a celestial object or planet that is seen in a circle
sentence	sentence in prison	an act of restraining someone or something
sentence	write up the sentence	a piece of text written to be printed

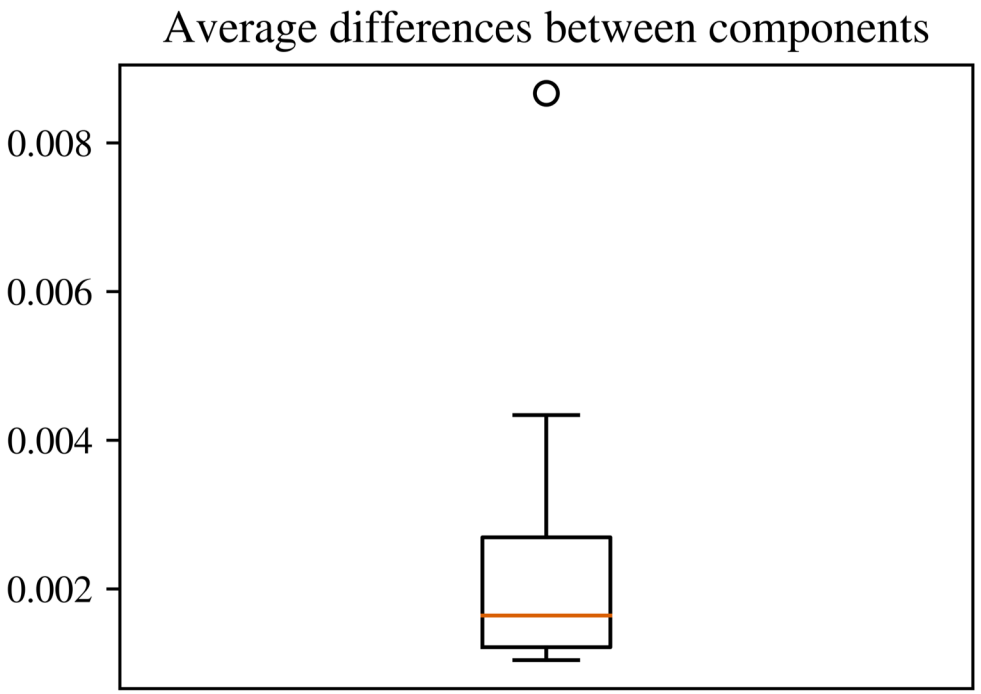
Experiments: mask exploration

- For word **w** take $\mathbf{C}_{\mathbf{verb}}$ and $\mathbf{C}_{\mathbf{noun}}$ contexts

- Compute $\mathbf{m}_{\mathbf{verb}}$ and $\mathbf{m}_{\mathbf{noun}}$ masks

- Look at boxplot for averaged diffences between $\mathbf{m}_{\mathbf{verb}}$ and $\mathbf{m}_{\mathbf{noun}}$

Experiments: mask exploration



Word	Noun Definition
judge	a person who is responsible for the legal proceedings of a jury
answer	a statement that solves a problem or explains how to solve the problem

Noun Context	Verb Definition
he is due to appear before a judge and jury on monday	act as a judge
he knocked and entered without waiting for an answer	express the opinion of

Takeaways

- Word embedding contains information about most of its meanings
- Even simple language model can restore word’s definition using word’s embedding