Representation Learning

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Update Examples

Imports

```
import gensim, logging
from gensim.models import Word2Vec
from nltk.corpus import brown, movie_reviews
```

Vectors from NLTK

```
f = '%(asctime)s : %(levelname)s : %(message)s'
logging.basicConfig(format=f, level=logging.INFO)

b = Word2Vec(brown.sents())
b_opt = Word2Vec(brown.sents(), size=150, window=10,
                                 min_count=2, workers=10,
                                 ns_exponent=0.75)

mr = Word2Vec(movie_reviews.sents())
```

Explore!

- What words are most different between different corpora

```
mr.most_similar('flop', topn=10)
```

- Play with different parameter settings (how small can embedding size get before it gets crappy, how does smaller window change nearest words, how does negative sampling exponent change things)
- Try it out on different datasets!
- Create a t-SNE (from sklearn.manifold import TSNE)

```
X = model.wv[model.wv.vocab]

tsne = TSNE(n_components=2)
X_tsne = tsne.fit_transform(X)

plt.scatter(X_tsne[:, 0], X_tsne[:, 1])
plt.show()
```

Dataset

- Two types of words
  - Vehicles
  - Fruits
- Learn a representation with two dimensions
- Word2Vec skipgram negative sampling
- $\alpha = 0.1$ (bad choice in practice!)
- We'll do update for one positive and one negative sample
  - Note: much of word2vec magic is sampling negative words, you'll have to take my word for it

Word		
ambulance	-0.228	0.099
apple	0.078	0.217
backhoe	-0.086	0.138
banana	0.046	0.195
crane	-0.220	0.153
firetruck	0.039	-0.047
lemon	0.008	-0.043
strawberry	0.202	-0.081

Context		
ambulance	0.000	0.000
apple	0.000	0.000
backhoe	0.000	0.000
banana	0.000	0.000
crane	0.000	0.000
firetruck	0.000	0.000
lemon	0.000	0.000
strawberry	0.000	0.000

$\alpha = 0.1$

POS (banana vs lemon)

- $z = w_{\text{banana}}^{\top} \cdot c_{\text{lemon}}$

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- $z = w_{\text{banana}}^{\top} \cdot c_{\text{lemon}} = 0.046 * 0.000 + 0.195 * 0.000$

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NEG (banana vs firetruck)

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lemon	0.008	-0.043
strawberry	0.202	-0.081

Context		
ambulance	0.000	0.000
apple	0.000	0.000
backhoe	-0.002	-0.010
banana	0.000	0.000
crane	0.000	0.000
firetruck	-0.002	-0.010
lemon	0.005	0.019
strawberry	0.000	0.000

$\alpha = 0.1$

Much later . . .

Vectors are starting to take shape

Word		
ambulance	-0.906	0.107
apple	0.992	0.780
backhoe	-0.902	0.459
banana	1.286	0.573
crane	-1.119	0.399
firetruck	-0.830	0.094
lemon	0.750	-0.289
strawberry	1.174	-0.379

Context		
ambulance	-0.927	-0.090
apple	0.973	-0.923
backhoe	-0.984	-0.379
banana	0.634	-0.486
crane	-1.258	-0.188
firetruck	-1.224	-0.060
lemon	1.087	-0.081
strawberry	1.054	0.410

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POS (firetruck vs backhoe)

- $z = w_{\text{firetruck}}^{\top} \cdot c_{\text{backhoe}}$

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- $z = w_{\text{firetruck}}^{\top} \cdot c_{\text{backhoe}} = -0.830 * -0.984 + 0.094 * -0.379 = 0.780$

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- $e = 1.0 - \pi = 1.0 - \sigma(0.780) = 0.314$

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- $\Delta w_{\text{firetruck}} = \alpha e \cdot c_{\text{backhoe}} = 0.10 \cdot 0.314 \cdot (-0.984, -0.379) = (-0.031, -0.012)$

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NEG (firetruck vs crane)

- $z = w_{\text{firetruck}}^{\top} \cdot c_{\text{crane}}$

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- $z = w_{\text{firetruck}}^{\top} \cdot c_{\text{crane}} = -0.830 * -1.258 + 0.094 * -0.188$

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backhoe	-1.035	-0.373
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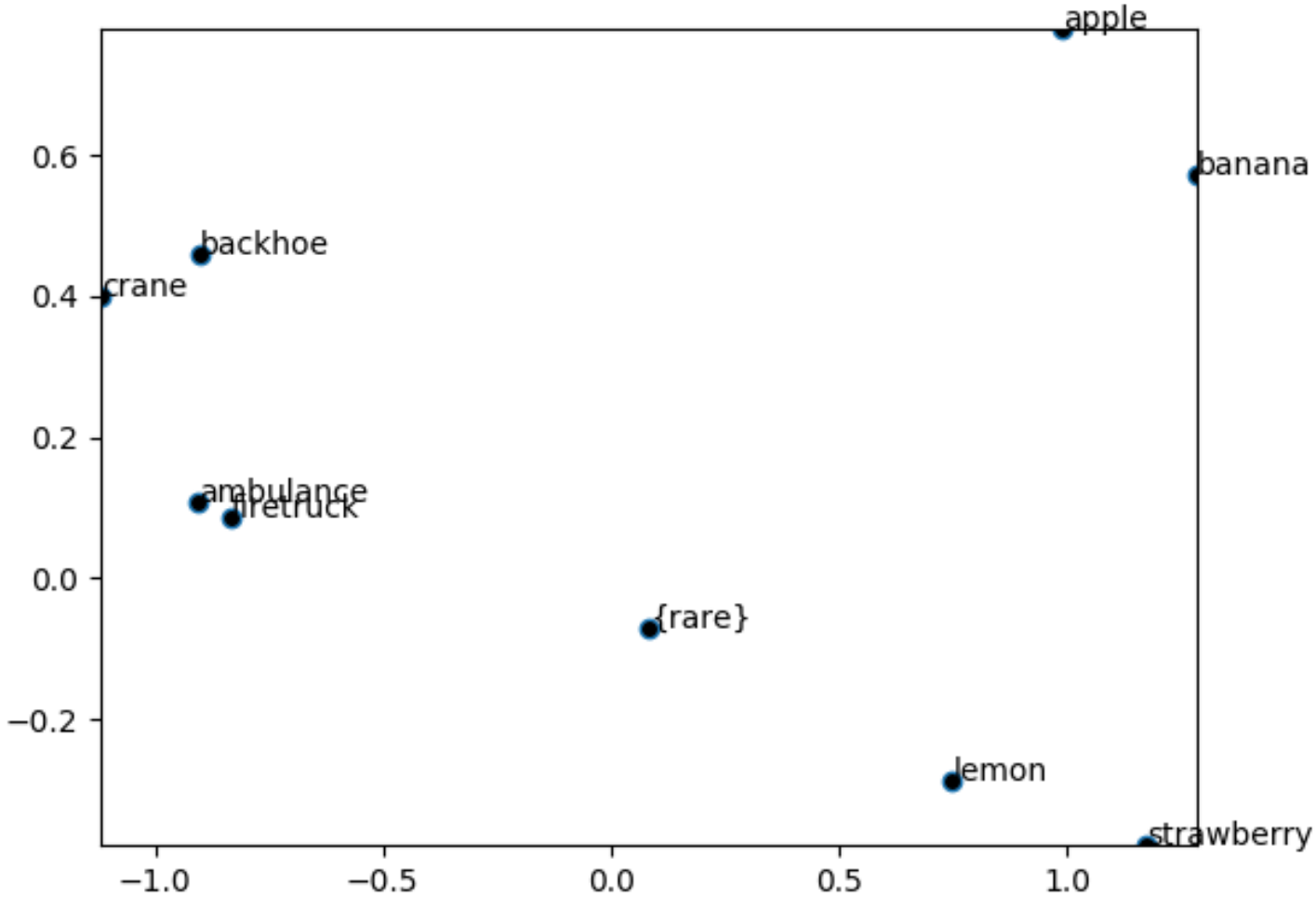
Word Vectors



Context Vectors