Word Embeddings

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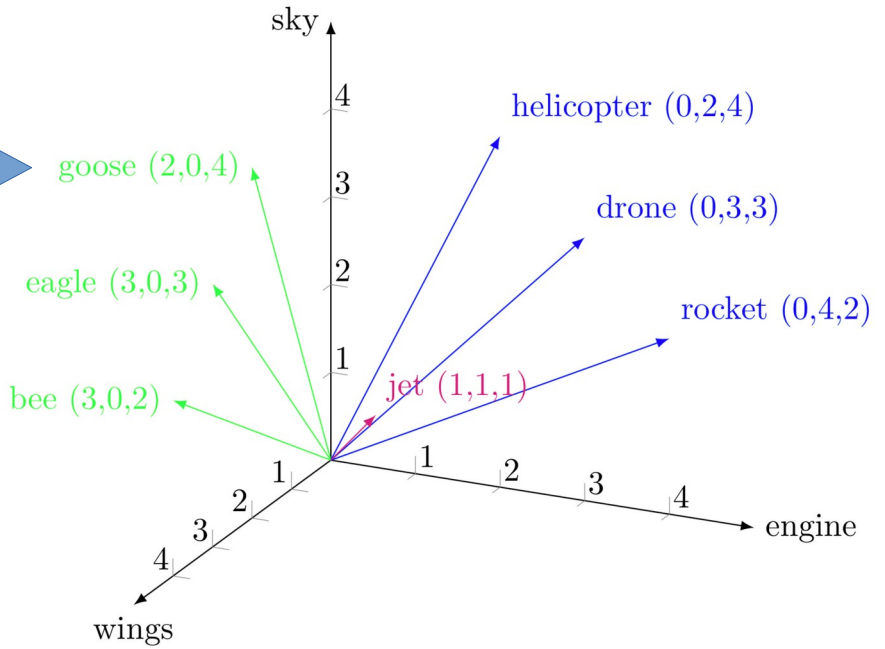
What are word embeddings?

Definition:
Representing a word as a vector in a vector space.

”Embedding” a word in a vector space.

What are word embeddings?

goose



What are word embeddings?

Why do we need to turn words into vectors?

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Why do we need to turn words into vectors?

- Machine learning models work with vectors
- We can do vector math
- We can quantify similarity between vectors

What are word embeddings?

How do we find the dimensions to use?

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- Expert knowledge

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- Expert knowledge
- Domain dependent

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How do we find the dimensions to use?

- Expert knowledge
- Domain dependent
- What can be dimensions for all English words?

One Hot Encoding

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Simplest approach: Using the index of the word

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What can be dimensions for all English words?

Simplest approach: Using the index of the word
→ Each word is its own “dimension”

One Hot Encoding

Example corpus:
A dog is an animal. A cat is an animal. My dog is playful. A cat is playful.

One Hot Encoding

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A dog is an animal. A cat is an animal. My dog is playful. A cat is playful.

Index (lower case):
0 → a
1 → an
2 → animal
3 → cat
4 → dog
5 → is
6 → my
7 → playful

One Hot Encoding

Example corpus:
A dog is an animal. A cat is an animal. My dog is playful. A cat is playful.

Index (lower case):
0 → a
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```
[([1, 0, 0, 0, 0, 0, 0, 0], 'a'),
 ([0, 1, 0, 0, 0, 0, 0, 0], 'an'),
 ([0, 0, 1, 0, 0, 0, 0, 0], 'animal'),
 ([0, 0, 0, 1, 0, 0, 0, 0], 'cat'),
 ([0, 0, 0, 0, 1, 0, 0, 0], 'dog'),
 ([0, 0, 0, 0, 0, 1, 0, 0], 'is'),
 ([0, 0, 0, 0, 0, 0, 1, 0], 'my'),
 ([0, 0, 0, 0, 0, 0, 0, 1], 'playful')]
```

Embeddings

One Hot Encoding

Embed a document:
”A dog is a playful animal”  `[2, 0, 1, 0, 1, 1, 0, 1]`

sum up the word embeddings for each word in the sentence

```
[([1, 0, 0, 0, 0, 0, 0, 0], 'a'),
 ([0, 1, 0, 0, 0, 0, 0, 0], 'an'),
 ([0, 0, 1, 0, 0, 0, 0, 0], 'animal'),
 ([0, 0, 0, 1, 0, 0, 0, 0], 'cat'),
 ([0, 0, 0, 0, 1, 0, 0, 0], 'dog'),
 ([0, 0, 0, 0, 0, 1, 0, 0], 'is'),
 ([0, 0, 0, 0, 0, 0, 1, 0], 'my'),
 ([0, 0, 0, 0, 0, 0, 0, 1], 'playful')]
```

Embeddings

One Hot Encoding

Pros and Cons:
+ Easy
+ Always works

- Very long → |V| size
- Sparse → all zeros except a single 1
- Add a word → all vectors need to be changed
- No relation between words encoded. Distance between any two words is always the same