3rd CAMELEON Workshop

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Distributional Similarity Models

Discovering related terms

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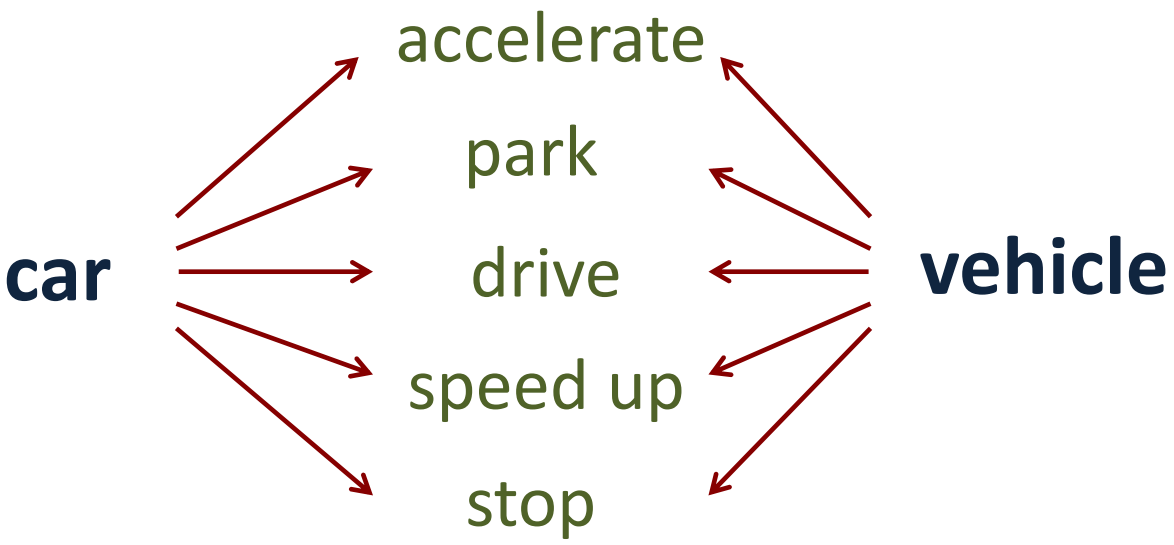
What are DSMs?

- **Distributional Similarity Models** (DSMs) identify similar words using the **distributional hypothesis** - Similar words appear in similar contexts (Harris, 1954).



Example

- Related terms to ***tezgüino*** (Lin, 1998)*:*

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A bottle of tezgüino is on the table.
Everyone likes tezgüino.
Tezgüino makes you drunk.
We make tezgüino out of corn.

Example

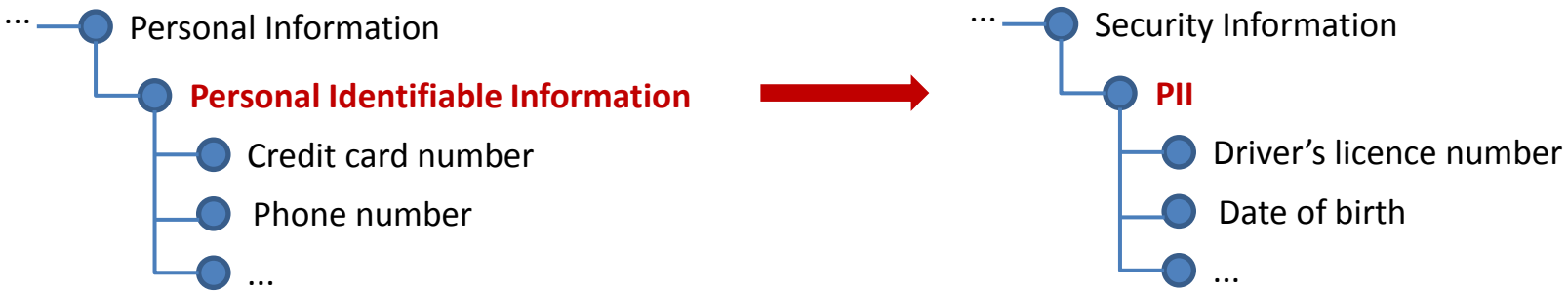
- Related terms to ***tezgüino*** (Lin, 1998)*:*

  A bottle of tezgüino is on the table.
  Everyone likes tezgüino.
  Tezgüino makes you drunk.
  We make tezgüino out of corn.

- **Tezgüino**: beer, wine, vodka etc.

Why should I look for similar terms?

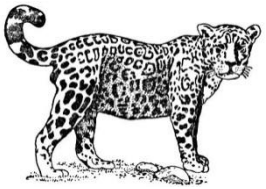
- Align ontology concepts



Why should I look for similar terms?

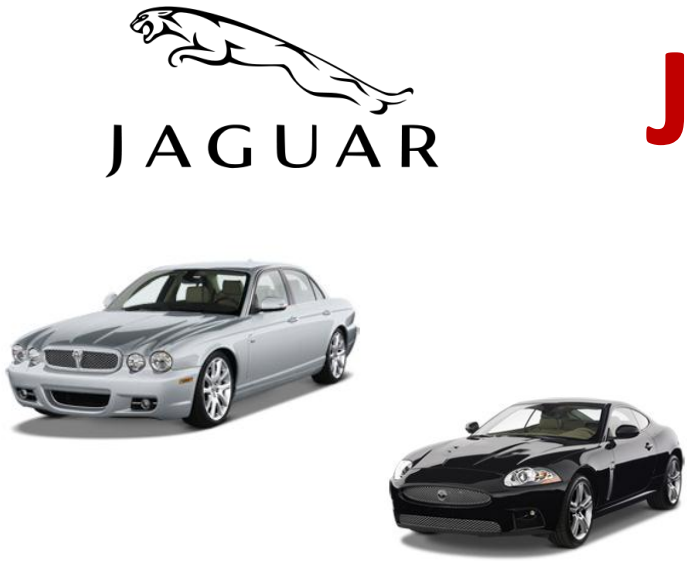
- Word Sense Disambiguation

Jaguar



Why should I look for similar terms?

- Word Sense Disambiguation



Jaguar

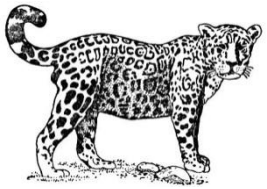
Related terms:
- Car
- Vehicle
- Taxi
- Passenger

Why should I look for similar terms?

- Word Sense Disambiguation

Related terms:
- Animal
- Cheetah
- Panther
- Tiger

Jaguar

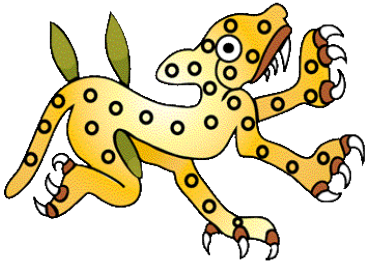


Why should I look for similar terms?

- Word Sense Disambiguation

Related terms :
- Mesoamerican
- Leopard
- Panther
- Maya

Jaguar



How can I find related terms?

- Statistical methods

"You shall know a word by the company it keeps."

John Rupert Firth (1957)

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
  - Extract terms in a window

Example:

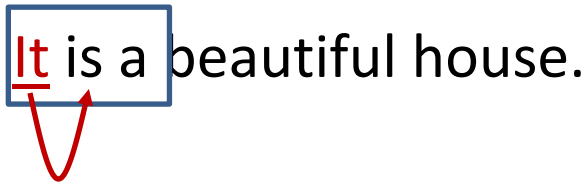
It is a beautiful house.

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
  - Extract terms in a window

Example:

- Window = 3 words



It – is = 1

How can I find related terms?

- Statistical methods
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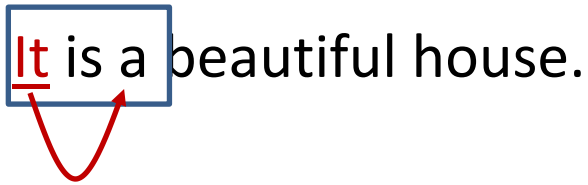
Example:

- Window = 3 words



It – is = 1
It – a = 1

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
  - Extract terms in a window

Example:

- Window = 3 words

It is a beautiful house.

It – is = 1
It – a = 1

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
  - Extract terms in a window

Example:

- Window = 3 words

It – is = 1
It – a = 1
Is – a = 1

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
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Example:

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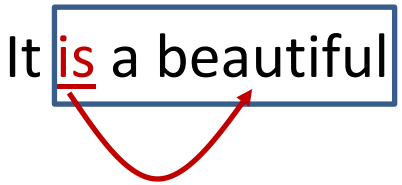

It – is = 1
It – a = 1
Is – a = 1

Is – beautiful = 1

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
  - Extract terms in a window

Example:

- Window = 3 words

It is a beautiful house.

It – is = 1
It – a = 1
Is – a = 1

Is – beautiful = 1

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
  - Extract terms in a window

Example:

- Window = 3 words

It – is = 1
It – a = 1
Is – a = 1

Is – beautiful = 1
A – beautiful = 1

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
  - Extract terms in a window

Example:

- Window = 3 words

It – is = 1
It – a = 1
Is – a = 1

Is – beautiful = 1
A – beautiful = 1
A – house = 1

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
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Example:

- Window = 3 words

It is a beautiful house.

It – is = 1
It – a = 1
Is – a = 1

Is – beautiful = 1
A – beautiful = 1
A – house = 1

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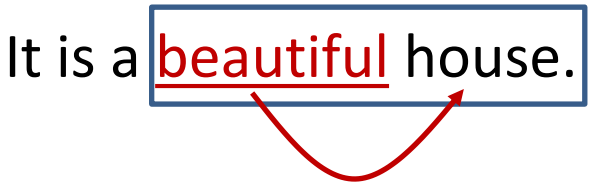


It – is = 1
It – a = 1
Is – a = 1

Is – beautiful = 1
A – beautiful = 1
A – house = 1

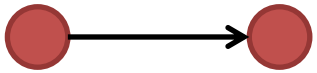
Beautiful – house = 1

How can I find related terms?

- Statistical methods
  - First oder co-occurrences
  - Extract terms in a window
  - Apply the Mutual Information (Church e Hanks, 1990)

$$MI(t_i, t_j) = log_2 \left(\frac{P(t_i, t_j)}{P(t_i)P(t_j)} \right)$$

Example



beautiful house

How can I find related terms?

- Using linguistic features

"Words that occur in the same contexts tend to have similar meanings."

Zellig Harris (1954)

How can I find related terms?

- Using linguistic features
  - Second order co-occurrences

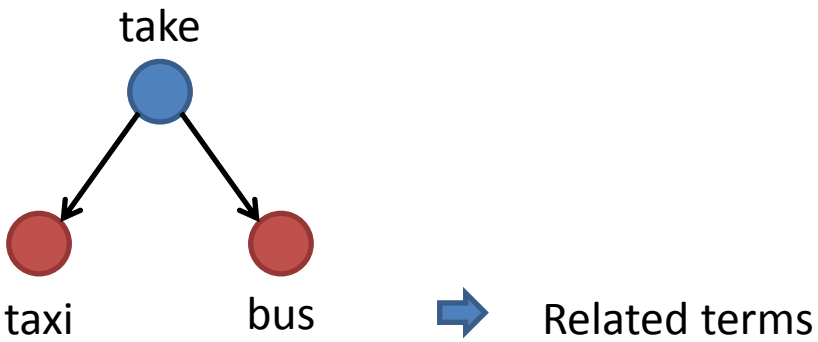
"Words that share **syntactic** contexts tend to have similar meanings."

Gregory Grefenstette (1994)

What is a context?

"Words that share **syntactic** contexts tend to have similar meanings."

Example:
- John took the taxi.
- Mary took the bus to go home.

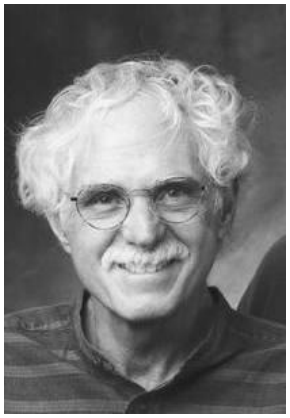


How can I find related terms?

- Using latent relations

"We assume that there is some underlying or 'latent' structure in the pattern of word usage that is partially obscured by the variability of word choice."

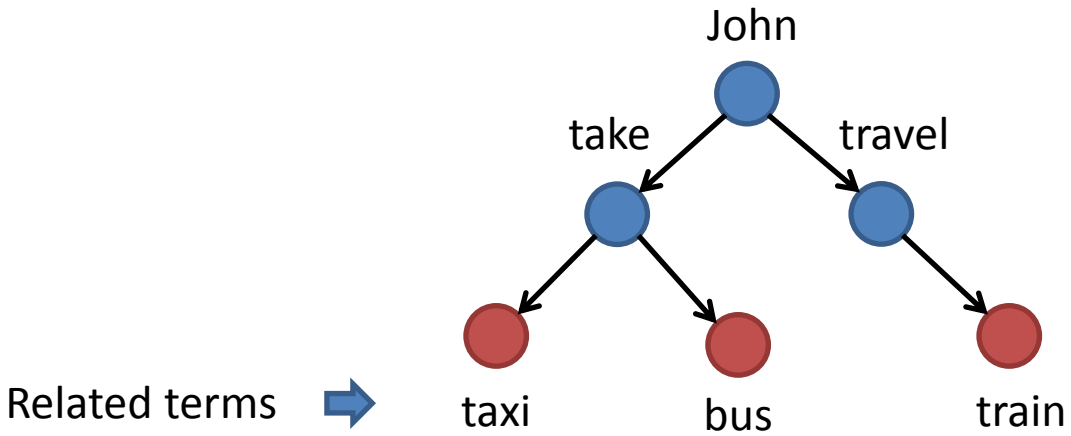
Thomas Landauer and
Susan Dumais (1997)



How can I find related terms?

- Using Latent Semantic Analysis (LSA)
  - Third (or more) order co-occurrence

Exemplo:
- John took the taxi.
- Mary took the bus to go home.
- John traveled by train.



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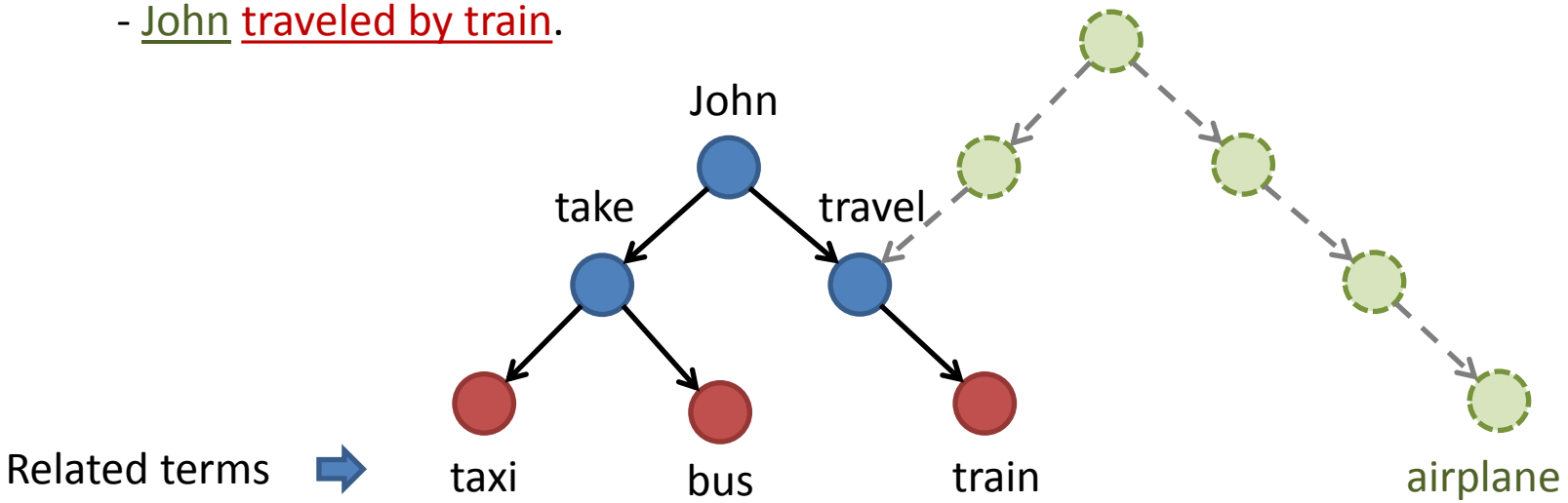
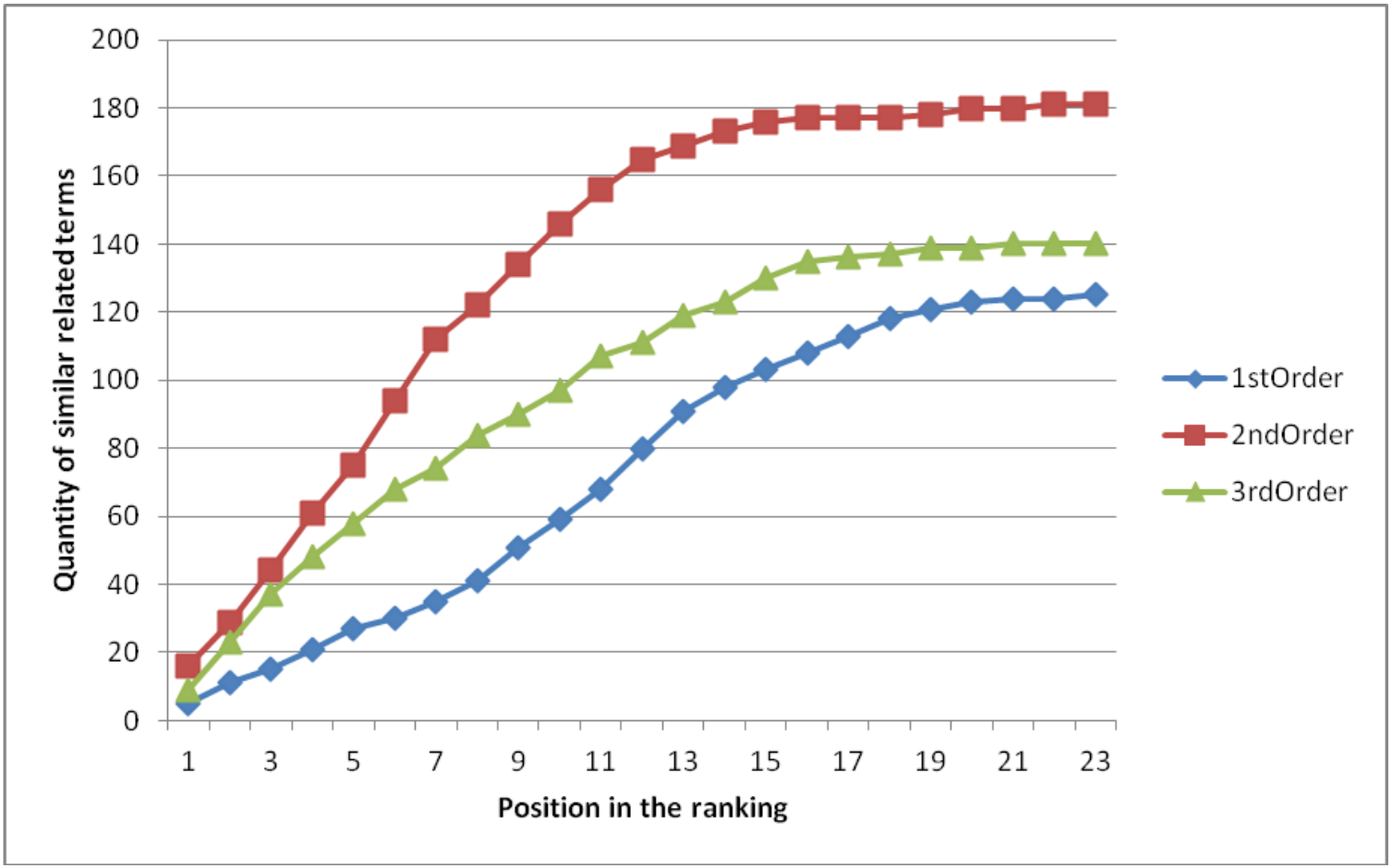


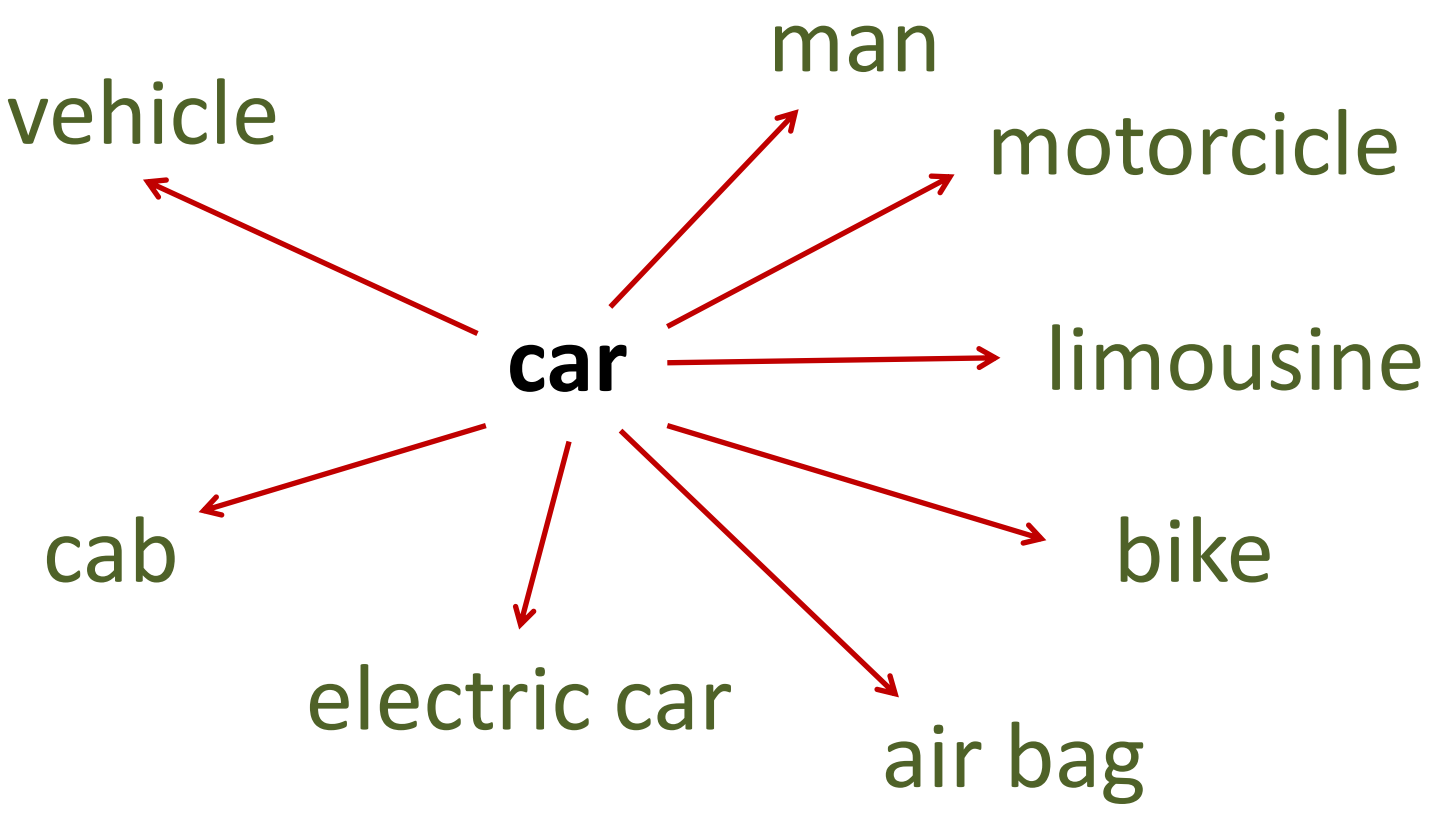
A comparison



But...

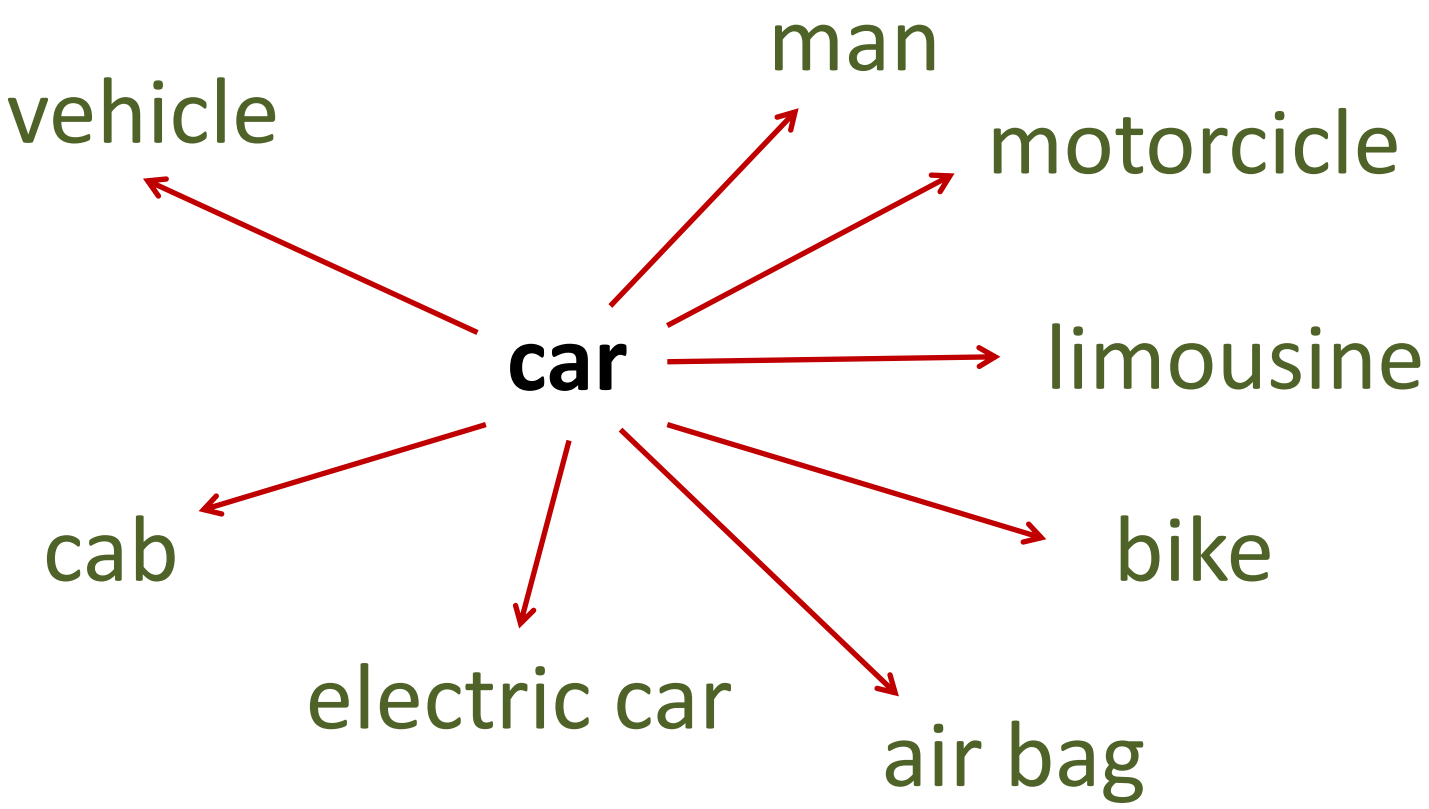
- Cross-lingual LSA (Hassan *et al*. 2012)
  - Appending documents in more than one language

Related terms?



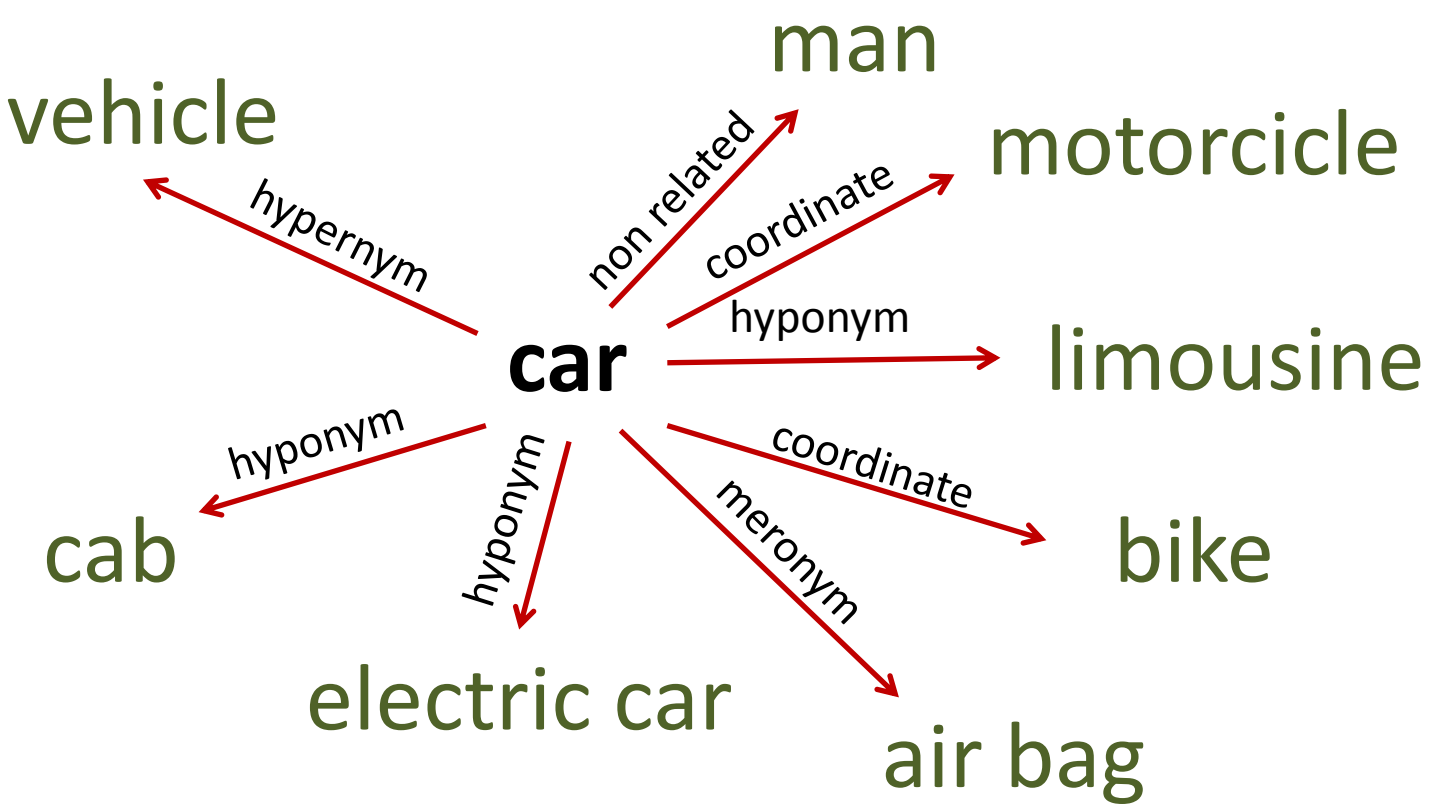
Related terms?

- But what is the relationship?



Related terms?

- But what is the relationship?



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Thanks for your attention!

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