# Employing Bert Embeddings for Customer Segmentation and Translation Matching

## SemaNLP 2020

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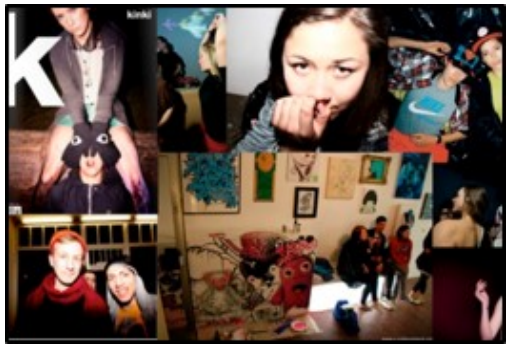
# CV

- 2001: Diploma Degree at Saarland University
- 2001-2003: Scientific Assistant at the German Research Center for Artificial Intelligence (DFKI)
- 2003-2006: Scientist at the German Meteorological Service
- 2006-2010: PhD Student at the Distance University of Hagen
- 2011-2015: Postdoc at Goethe University Frankfurt am Main
- 2015-now: Research Associate at Lucerne University of Applied Science and Arts
- 2019-now: Lecturer at FFHS (Fernfachhochschule Schweiz)

# Task: assign people to marketing target groups

- Our business partner operates a Website where he organizes several contests
- in these contests, people can win things like bicycles, MacBook, pair of sneakers
- For that, people had to come up with a short description what to do with their prize, or what they want to do in their dream holiday
- The participants of the contests were matched to one of 6 target groups

# Target Groups


NITRO CIRCUS


Keywords

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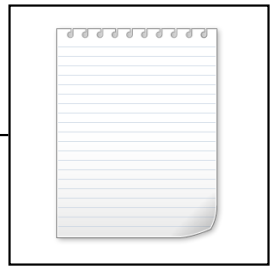
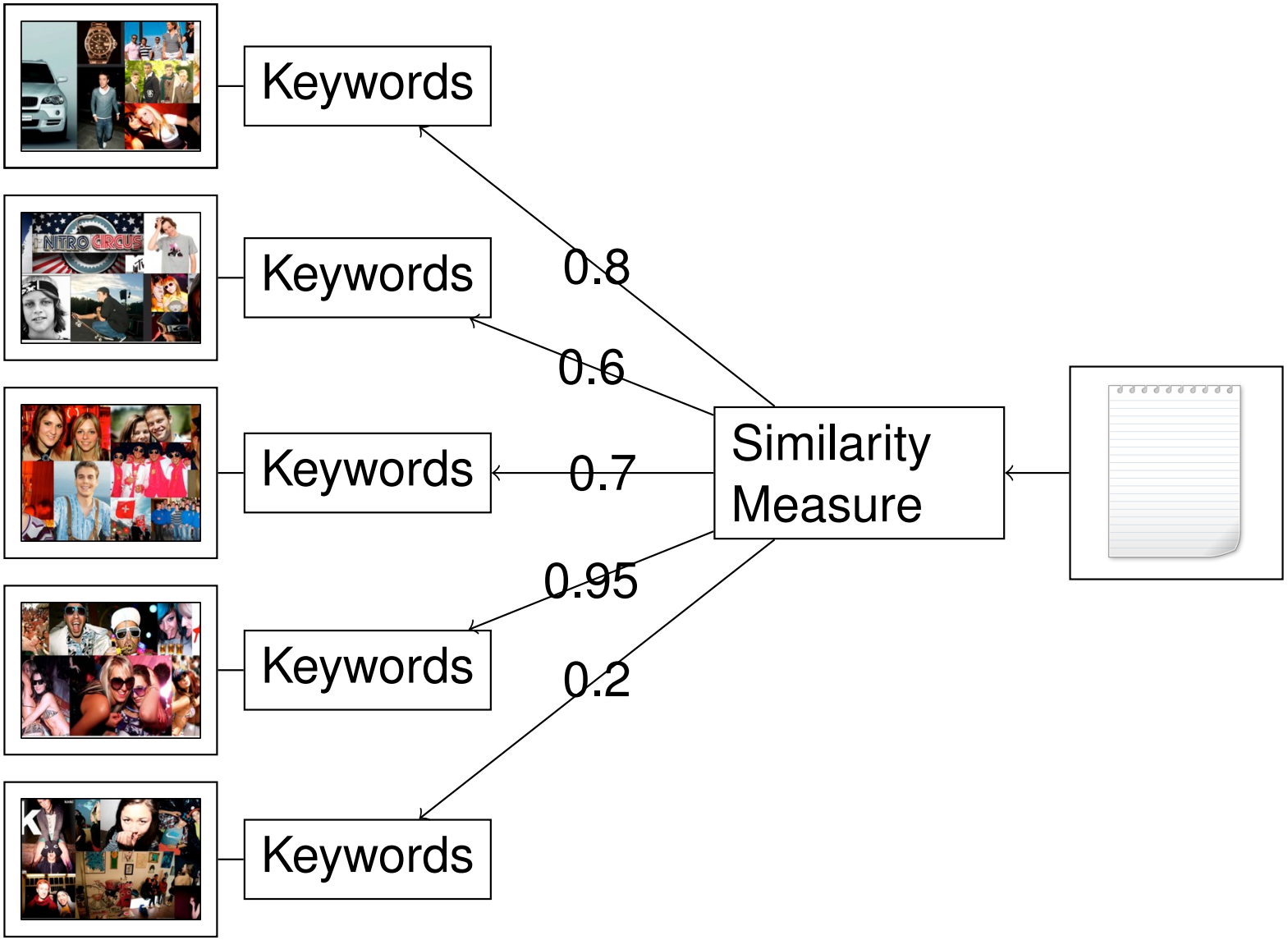
Similarity Measure

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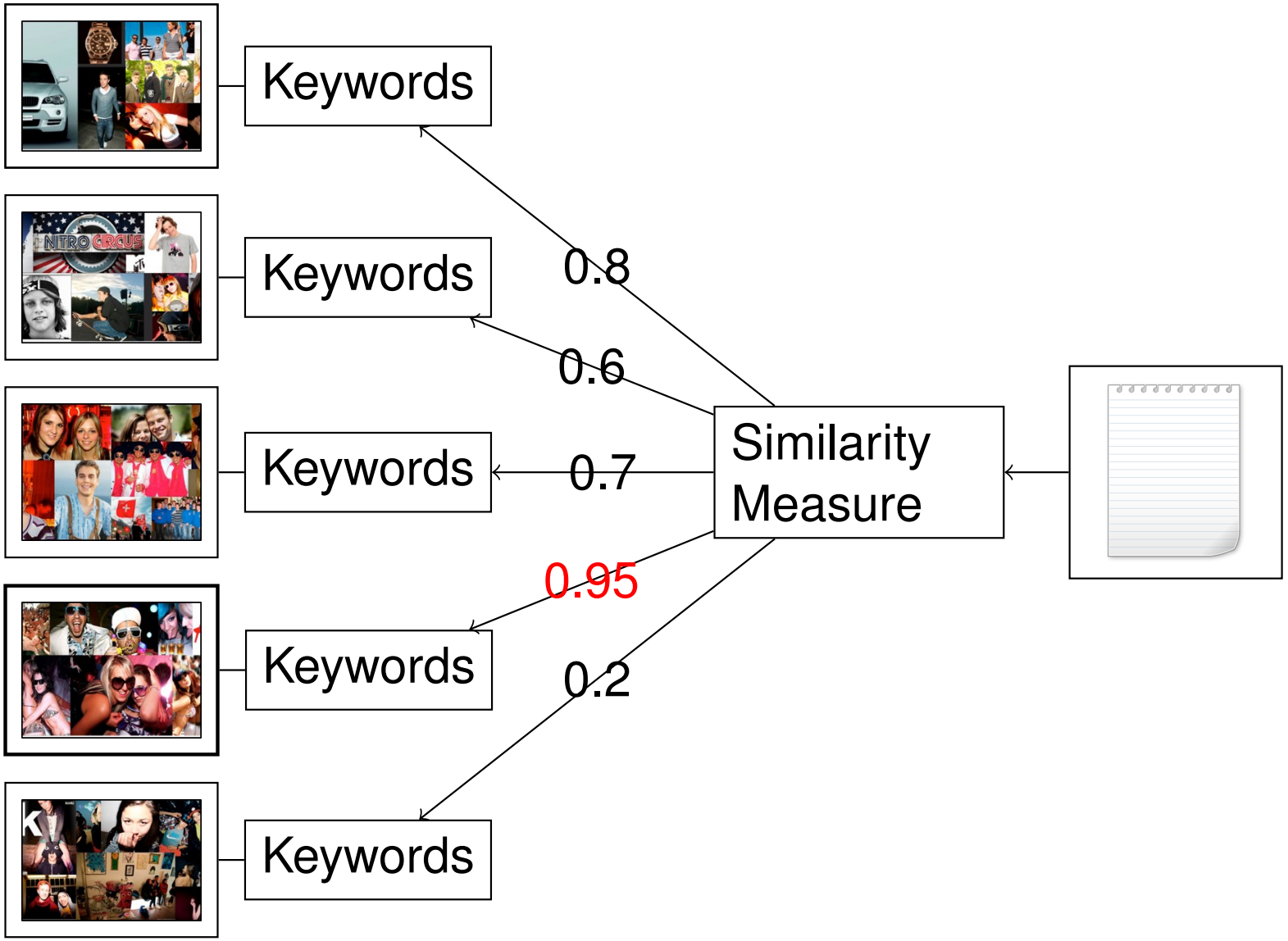
Similarity Measure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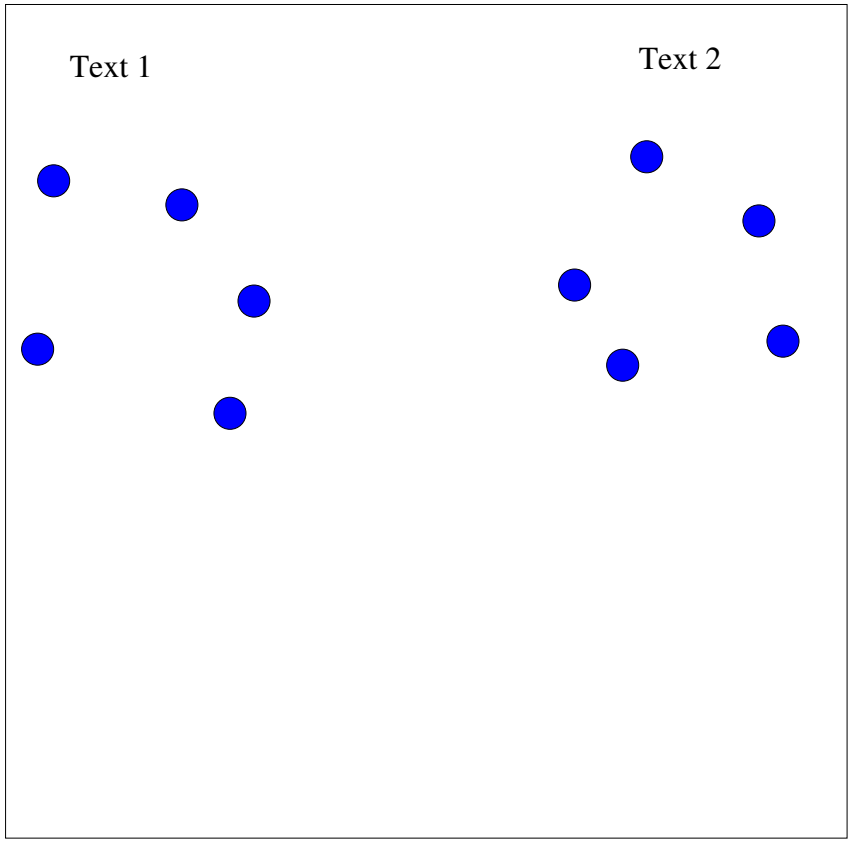
Similarity Measure

# Standard approach - Centroid of Embeddings (CE)



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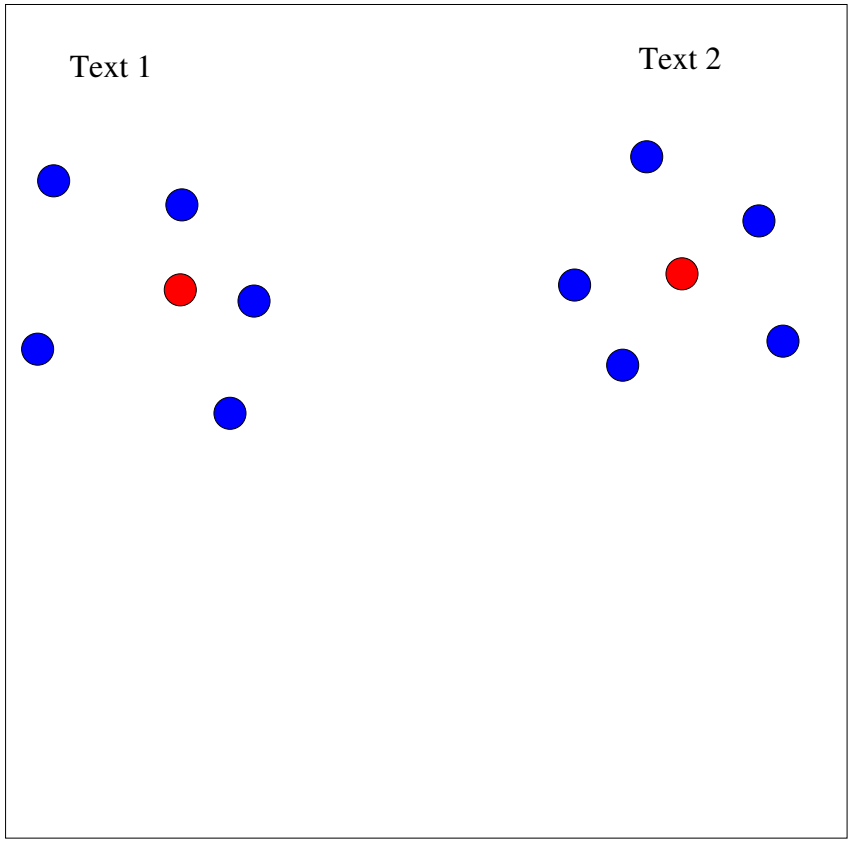

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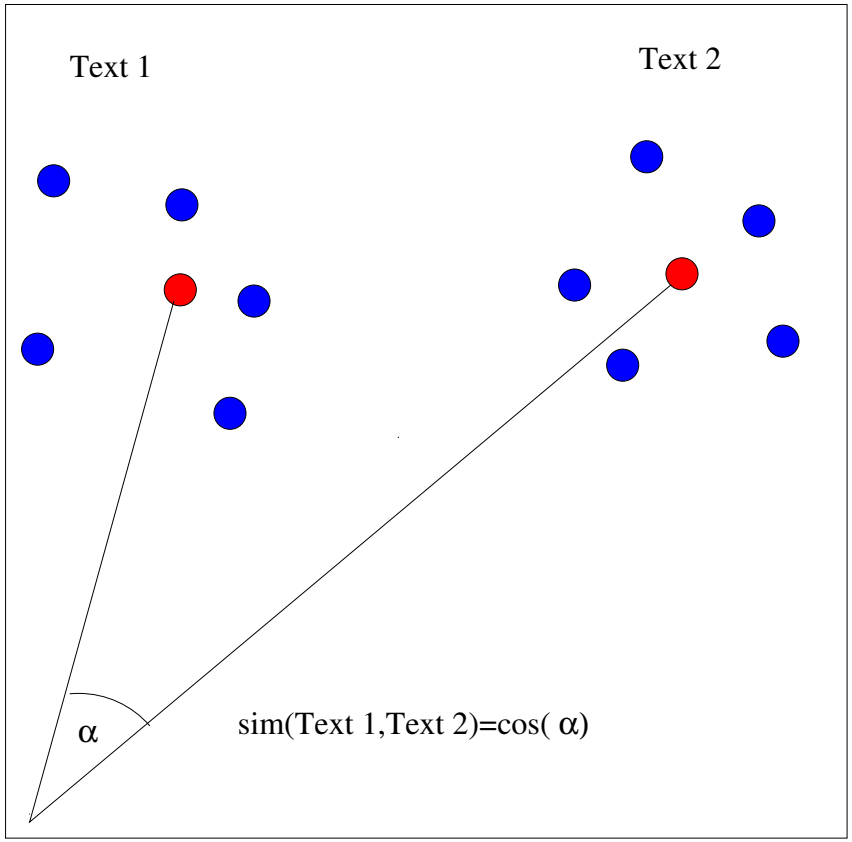


# Standard approach (CE)

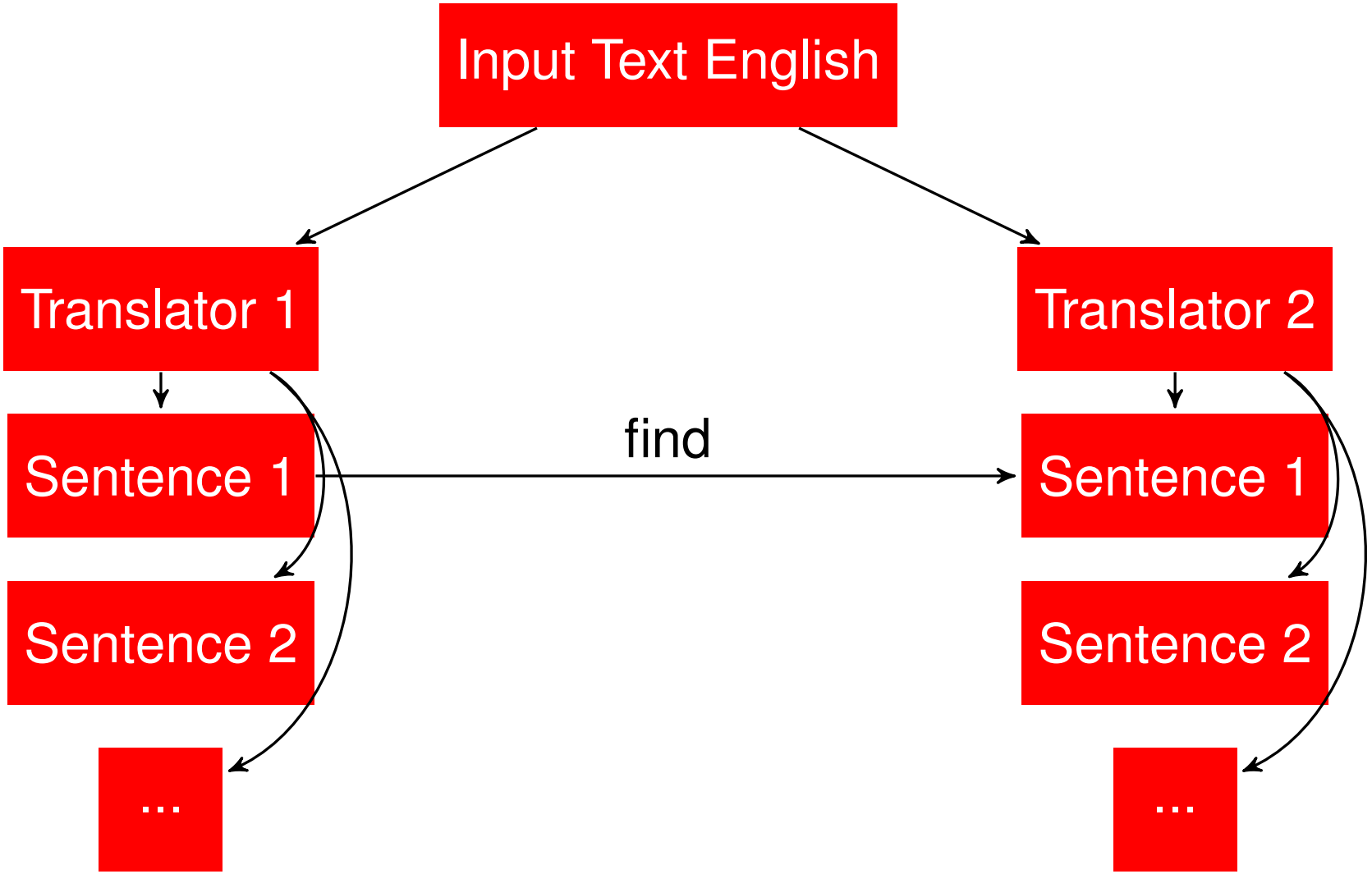
Task: Estimate semantic similarity of text *s* and text *t*

- Compute word embeddings for all words occurring in text *s* and *t*
- Compute the two centroids *cs* and *ct* of the word embeddings
- Similarity is given by: $cos(\angle(cs, ct))$

# Translation Matching

- One text (The Purloined Letter from Edgar Allen Poe) was translated by two independent translators into German
- Task: Matching one sentence of the first translation to the associated sentence of the second translation
- Match sentences where the cosine measure applied on embeddings centroids is maximal

# Translation-Matching



# Bert

- Bert stands for Bidirectional Encoder Representations from Transformers
- Ordinary word embeddings
  - do not consider word senses
  - word context is considered only during training
  - embeddings of a word independent from current word context
- This is different for Bert, Bert embeddings represent the sense (reading) of the current word
- Bert embeddings cannot be stored in global hashtable, but have to be generated on the fly by deep neural network

We used two ways to generate Bert embedding centroids

- average over all Bert word embeddings
- use only embeddings of the “sentence beginning token” representing the entire sentence

# Customer Segmenation

| Method | Accuracy | | | |
|---|---|---|---|---|
| | Contest 1 | Contest 2 | Contest 3 | Total |
| Word2Vec | 0.347 | 0.328 | 0.227 | 0.330 |
| Bert (AW) | 0.046 | 0.223 | 0.061 | 0.118 |
| Bert (ST) | 0.109 | 0.149 | 0.136 | 0.07 |

# Translation Matching

| Method | Accuracy |
|---|---|
| W2VC | 0.726 |
| Bert (ST) | 0.423 |
| Bert (AW) | 0.279 |
| Random | 0.010 |

# Discussion

- Very poor results for Bert embeddings for customer segmentation
- Results for translation matching were better but still lagging behind Word2Vec embeddings
- Possible reasons
  - Use of multilingual model
  - keyword list is arbitrarily ordered and not like ordinary sentence

# Conclusion

- We applied Bert and Word2Vec embeddings on two NLP scenarios
  - Customer segmentation
  - Translation matching
- Bert embeddings clearly outperformed by Word2Vec embeddings
- Next steps: Using
  - other embeddings methods like ELMo
  - monlingual embeddings