Universität Hamburg
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Alexander Panchenko

FROM UNSUPERVISED INDUCTION OF LINGUISTIC STRUCTURES FROM TEXT TOWARDS APPLICATIONS IN DEEP LEARNING

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In close collaboration with ...

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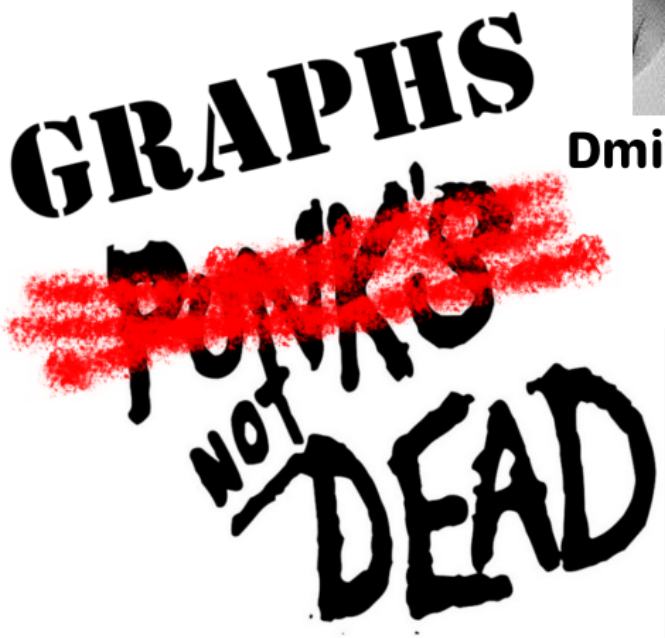

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- **Hubert Naets**
- **Maria Pelevina**
- **Anastasiya Lopukhina**
- **Konstantin Lopukhin**

Motivation

Deep Learning: everything is a vector

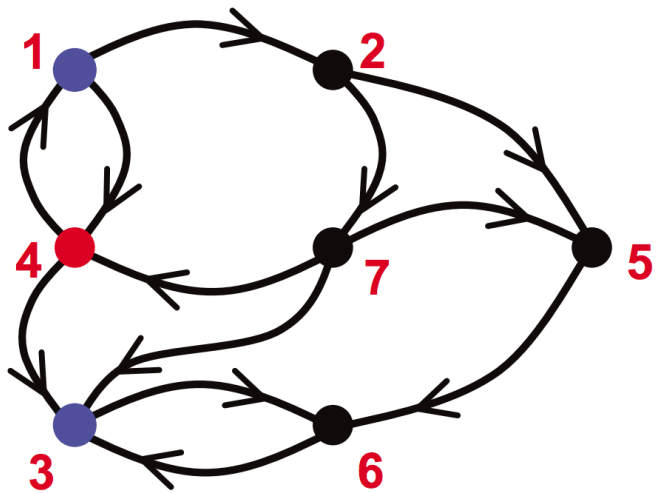
Levels of Linguistic Analysis

Image source: `https://commons.wikimedia.org/wiki/File:Major_levels_of_linguistic_structure.svg`

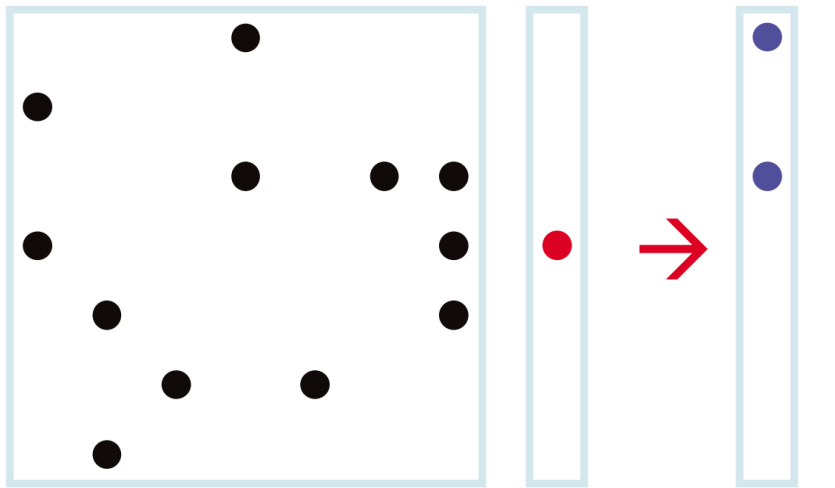
Linguistic Structures and Graphs

- (Written) language is a symbolic system

Graph Matrix Duality

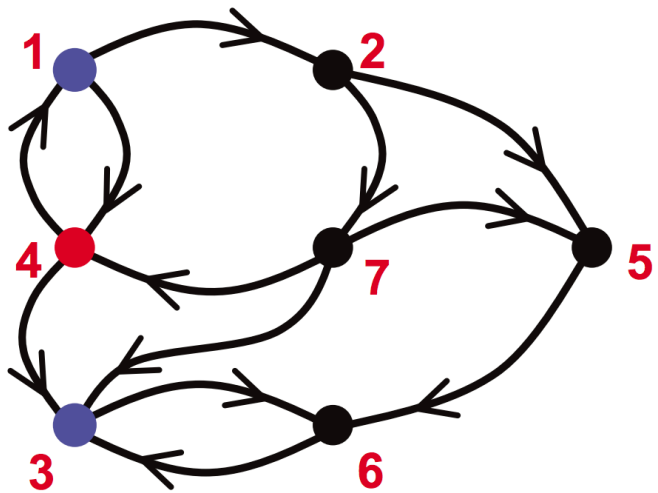


$$G = (V,E)$$

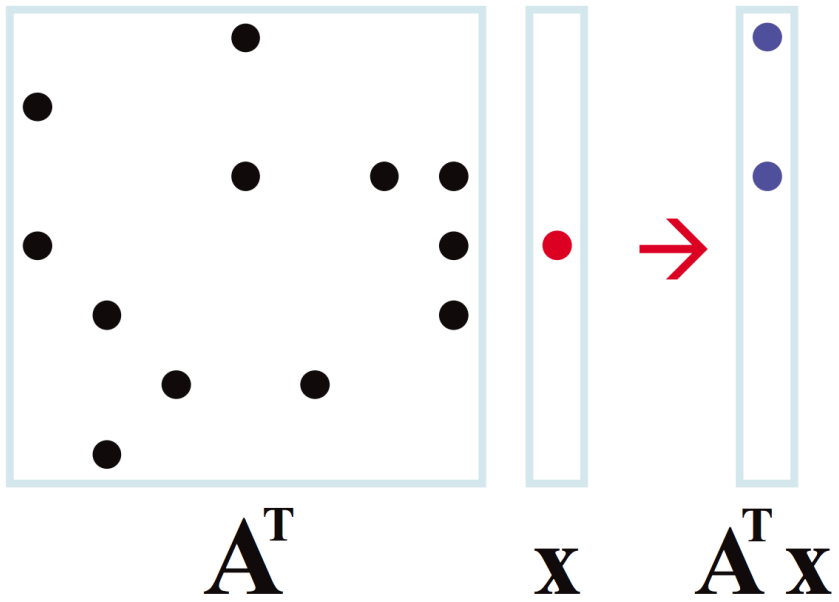


$$\mathbf{A}^T \quad \mathbf{x} \quad \mathbf{A}^T\mathbf{x}$$

Graph Matrix Duality



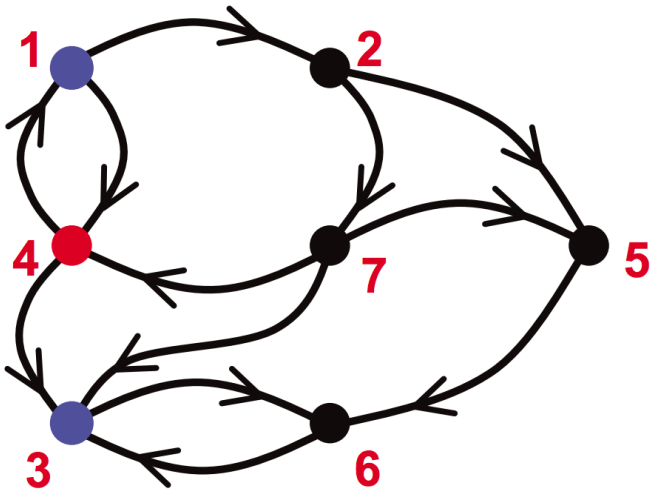
$$G = (V,E)$$



$$\mathbf{A}^T \quad \mathbf{x} \quad \mathbf{A}^T\mathbf{x}$$

- Adjacency matrix $\mathbf{A}$ is dual with the corresponding graph G.

Graph Matrix Duality



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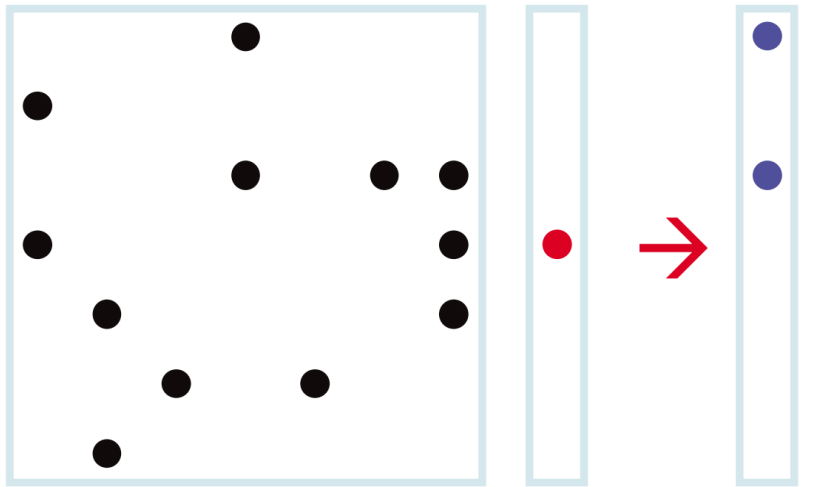

$$\mathbf{A}^{\mathbf{T}} \quad \mathbf{x} \quad \mathbf{A}^{\mathbf{T}}\mathbf{x}$$

- Adjacency matrix $\mathbf{A}$ is dual with the corresponding graph G.
- Vector matrix multiply $\mathbf{A}^T\mathbf{x}$ is dual with breadth-first search.

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1. Learn the interpretable symbolic structures from text in an unsupervised way, which are more complex than tokens and lemmas.
2. Represent the learned structures in the vector form.
3. Use the vector representations instead/in addition to word embedding the deep learning applications.
4. More complex structures could improve performance, but also provide better interpretability of the deep learning models.