AUTHORSHIP VERIFICATION

GRAPH-BASED SIAMESE NETWORK FOR AUTHORSHIP VERIFICATION

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OUTLINE

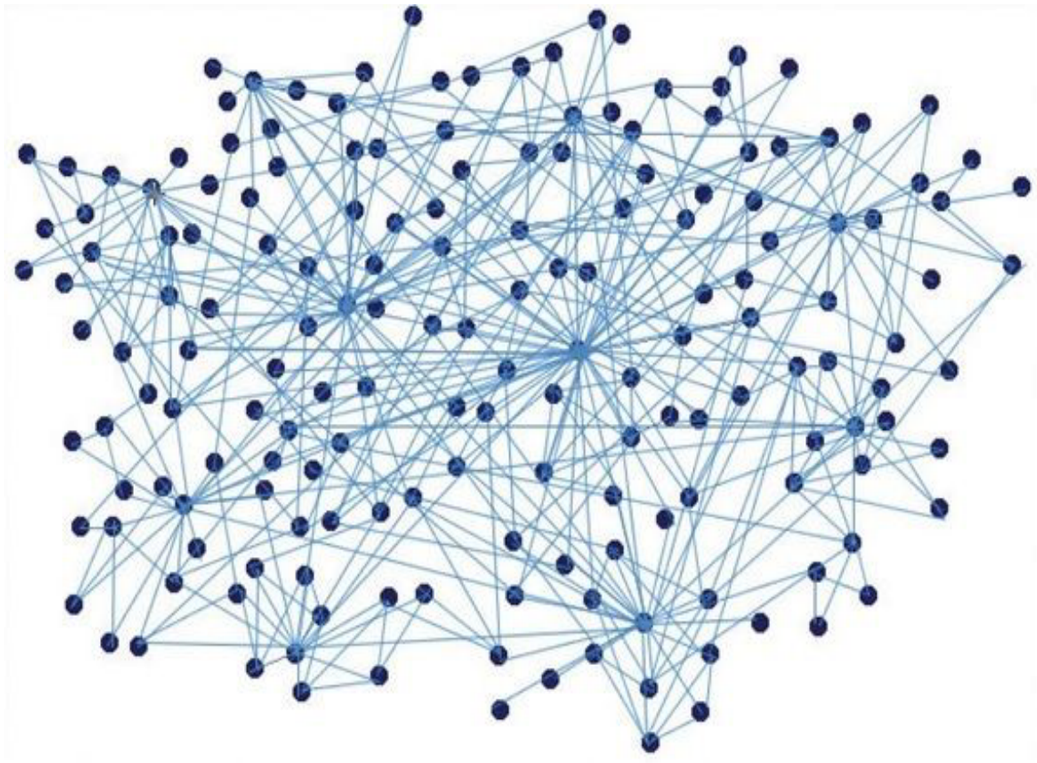
- Authorship Verification
- Model Overview
- Relevant details:
  - Modeling texts as graphs
  - Graph-based Siamese Network
  - GBSN Ensemble
- Submitted model
- Results
- Conclusions

AUTHORSHIP VERIFICATION

- Is the task of determining if two texts were written by the same author.

MODEL OVERVIEW

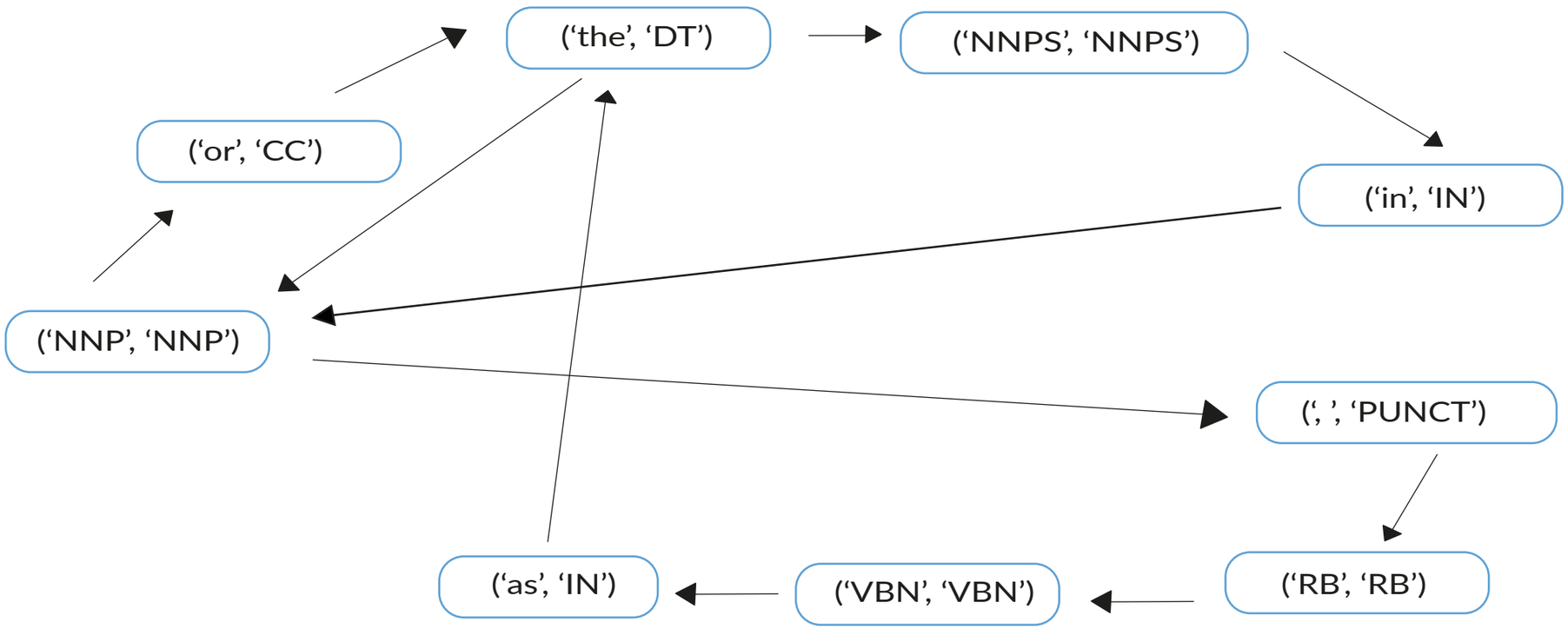
- Represent texts as graphs.
- Let a graph neural network automatically extract features.
- Use these ideas inside a Siamese Network.



MODELING TEXTS AS GRAPHS

Input: “Momo, also known as The Grey Gentlemen or the Men in Grey”

REDUCE_LABELS = {NNP, NNPS, VBN, RB}



PREPROCESS

Input: “Momo, also known as The Grey Gentlemen or the Men in Grey”

REDUCE_LABELS = {NNP, NNPS, VBN, RB}

- Subsitute non-ASCII characters.
- Tokenize.
- Get POS labels (we use Treebank plus PUNCT and OTHER).
- Normalize to lowercase.

PREPROCESS

Input: “Momo, also known as The Grey Gentlemen or the Men in Grey”

REDUCE_LABELS = {NNP, NNPS, VBN, RB}

Processed:
[(’momo’, ‘NNP’), (’ , ‘, ’PUNCT‘), (’also’, ‘RB’), (’known’, ‘VBN’), (’as’, ‘IN’), (’the’, ‘DT’), (’grey’, ‘NNP’), (’gentlemen’, ‘NNP’), (’or’, ‘CC’), (’ther’, ‘DT’), (’men’, ‘NNPS’), (’in’, ‘IN’), (’grey’, ‘NNP’)]

GRAPH CONSTRUCTION

Input: “Momo, also known as The Grey Gentlemen or the Men in Grey”

REDUCE_LABELS = {NNP, NNPS, VBN, RB}

Processed: [(’Momo’, ‘NNP’), (’ , ‘, ’PUNCT’), …]

- It is a co-ocurrence based construction.
- The nodes will be tuples (token, label).
- The edges occur if and only if the tokens appear together in text.

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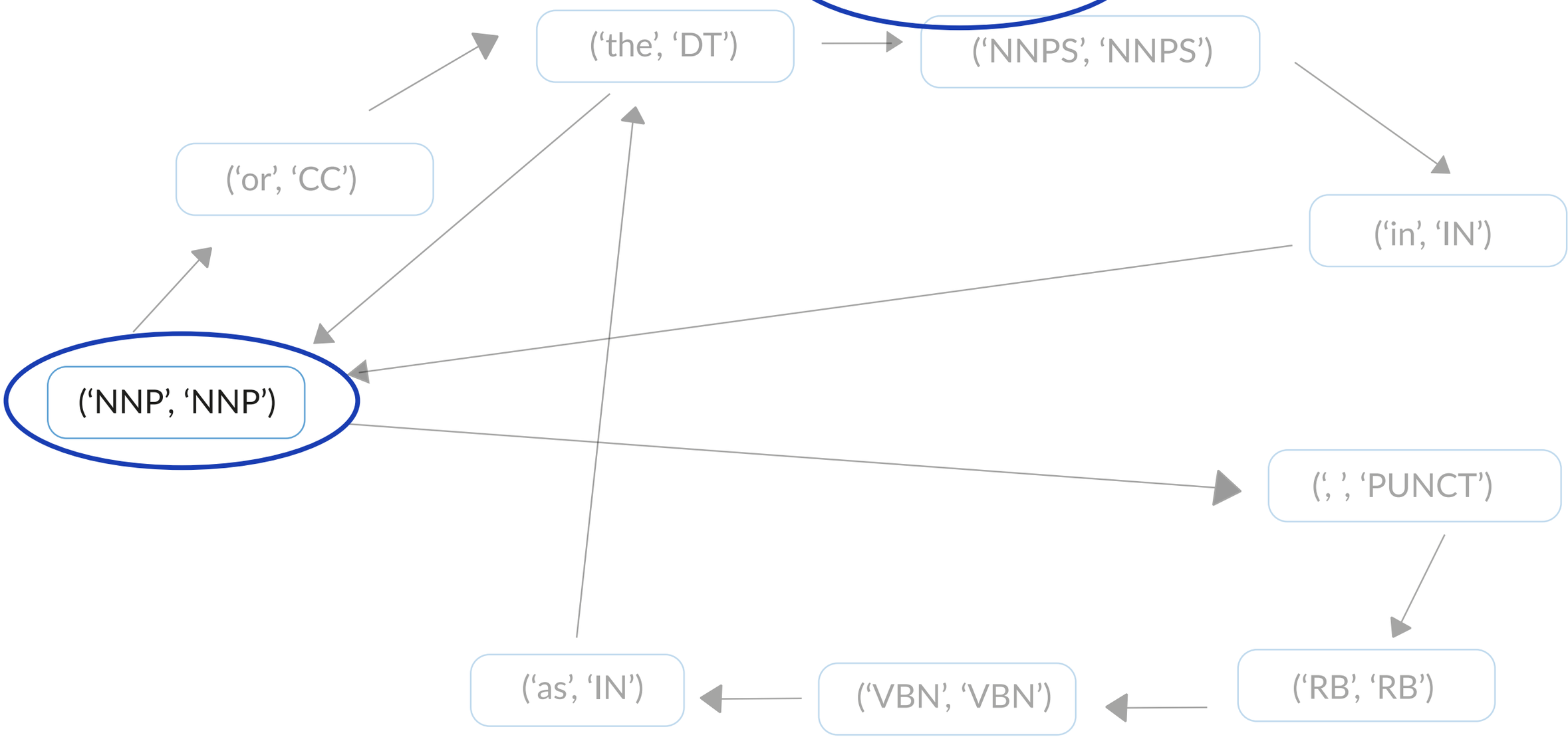

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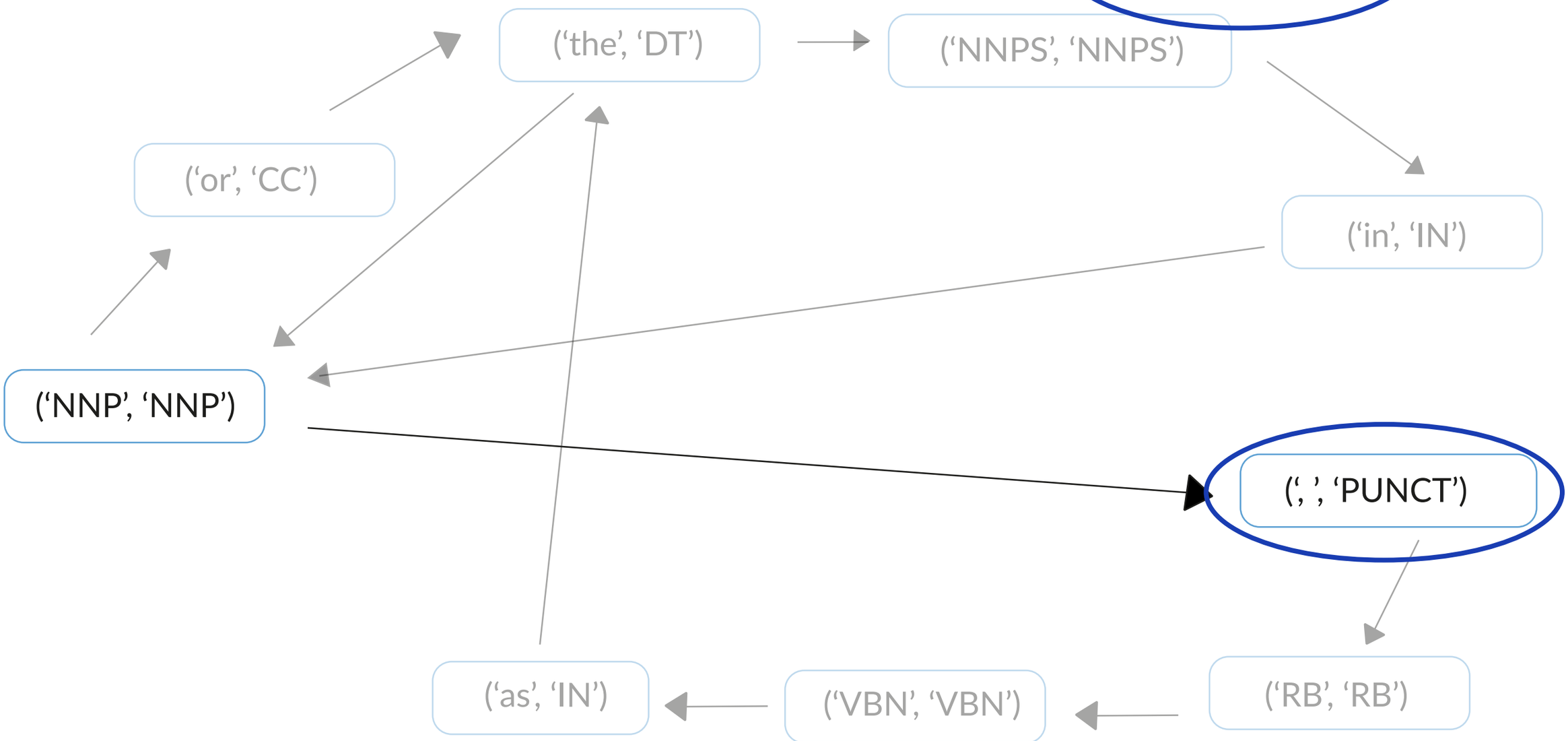

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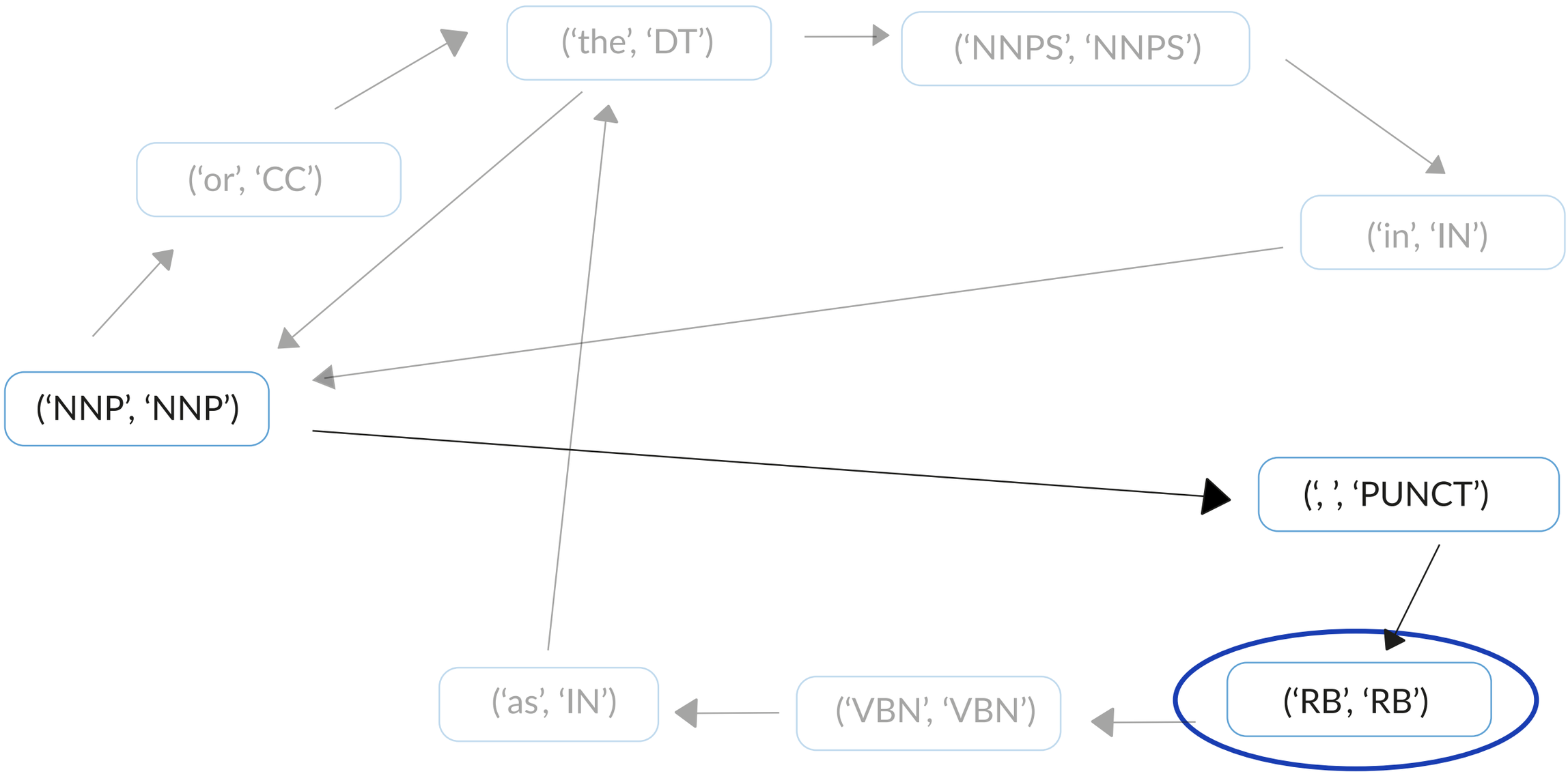

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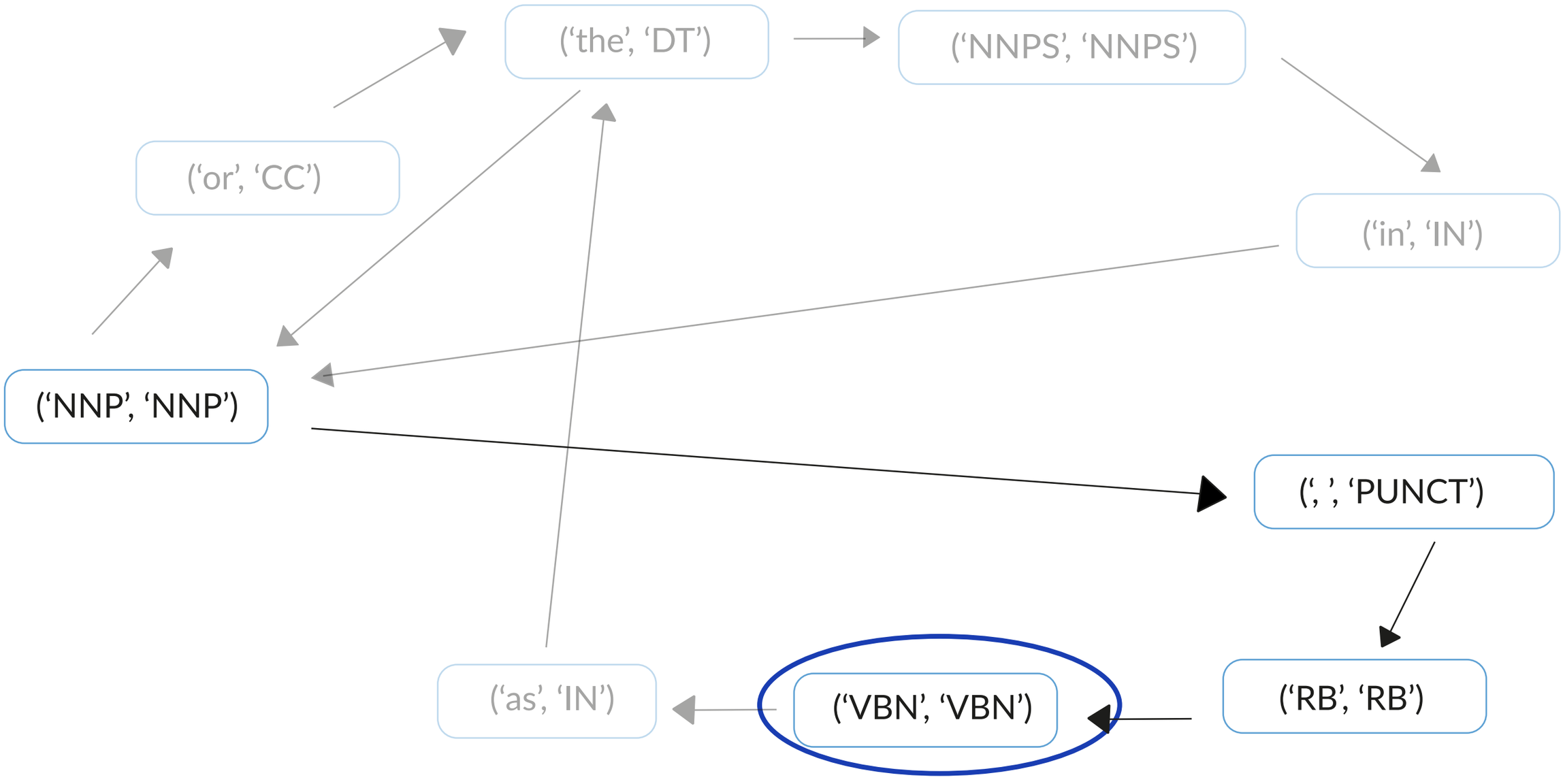

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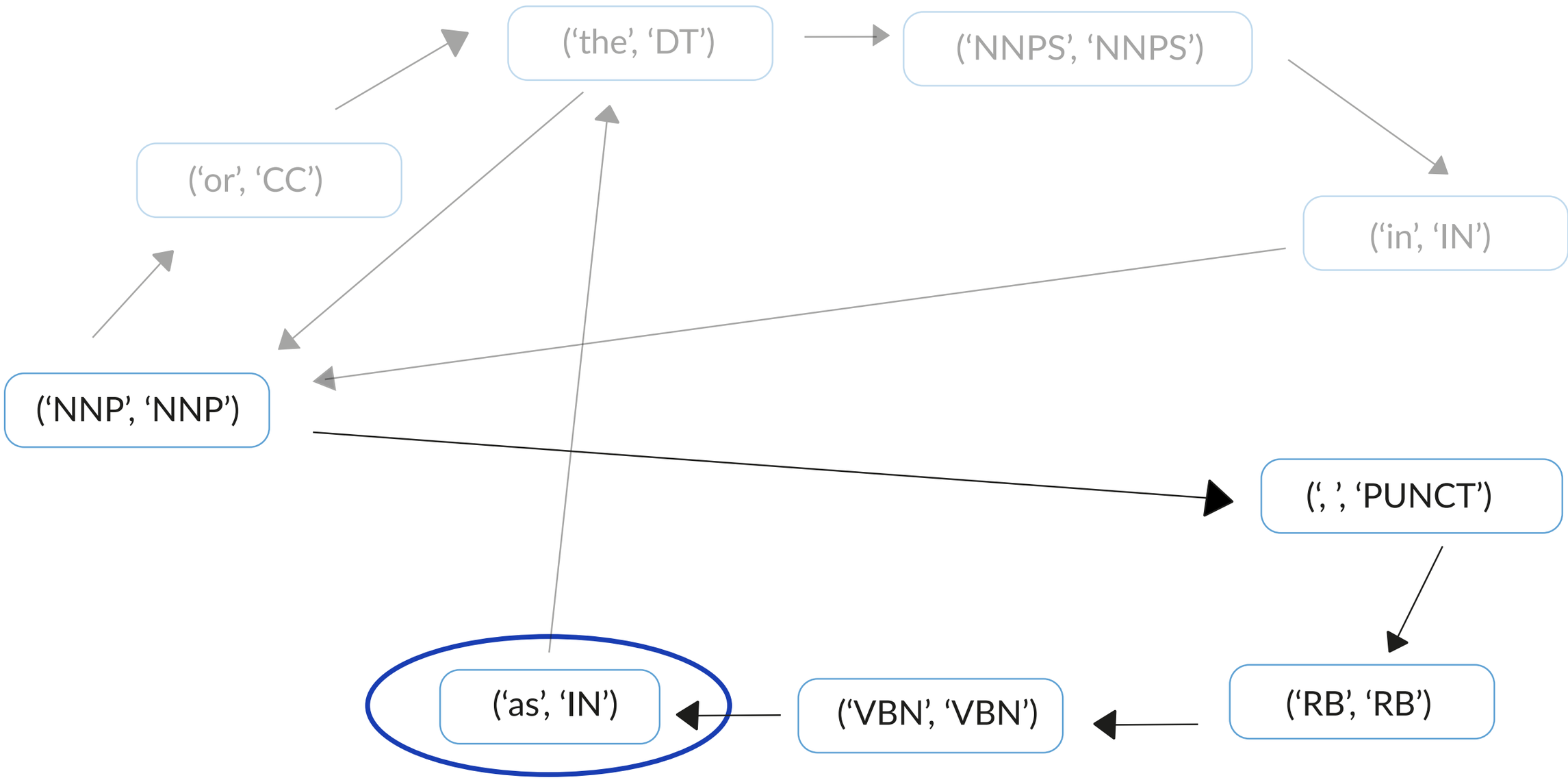

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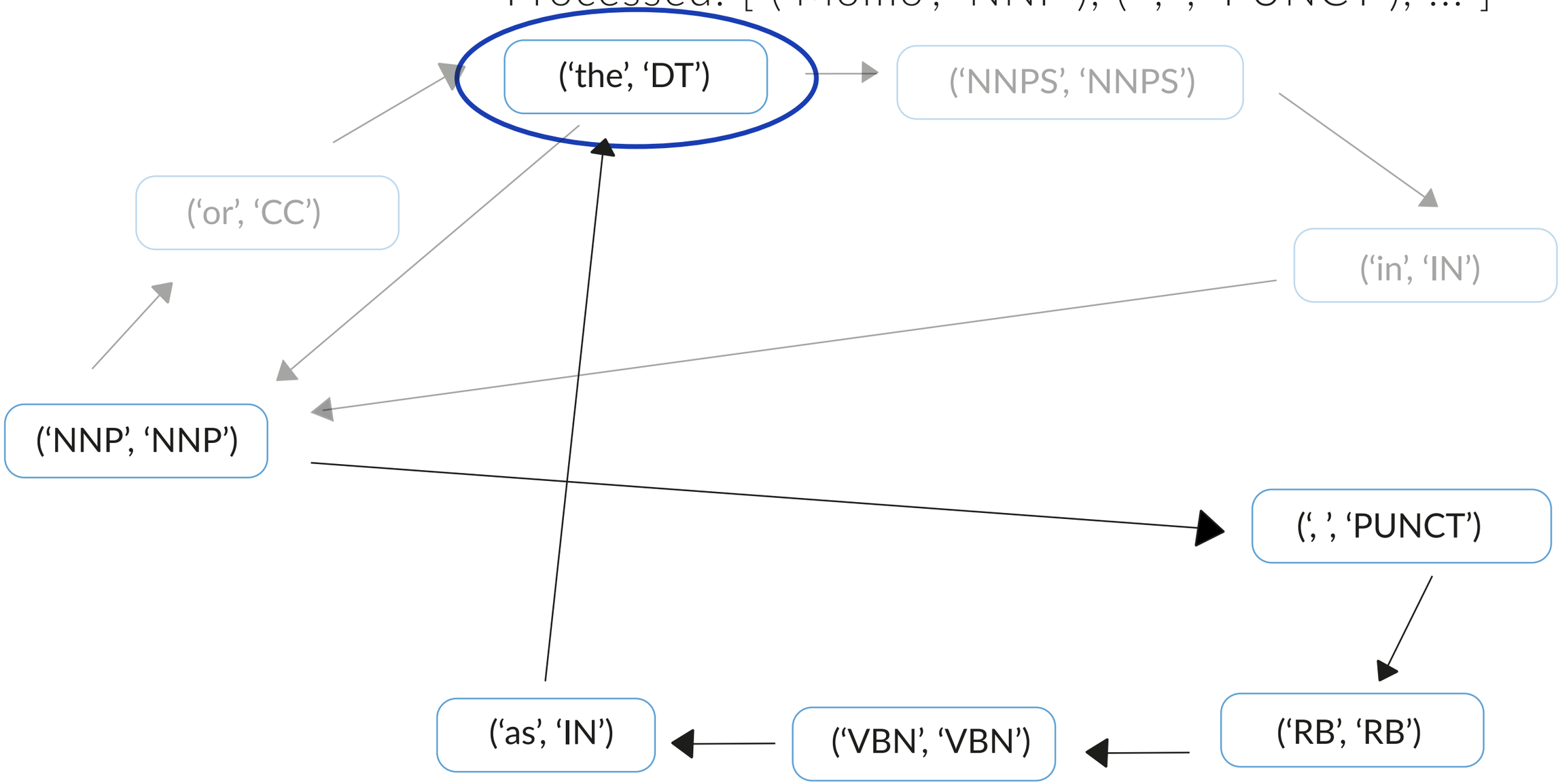

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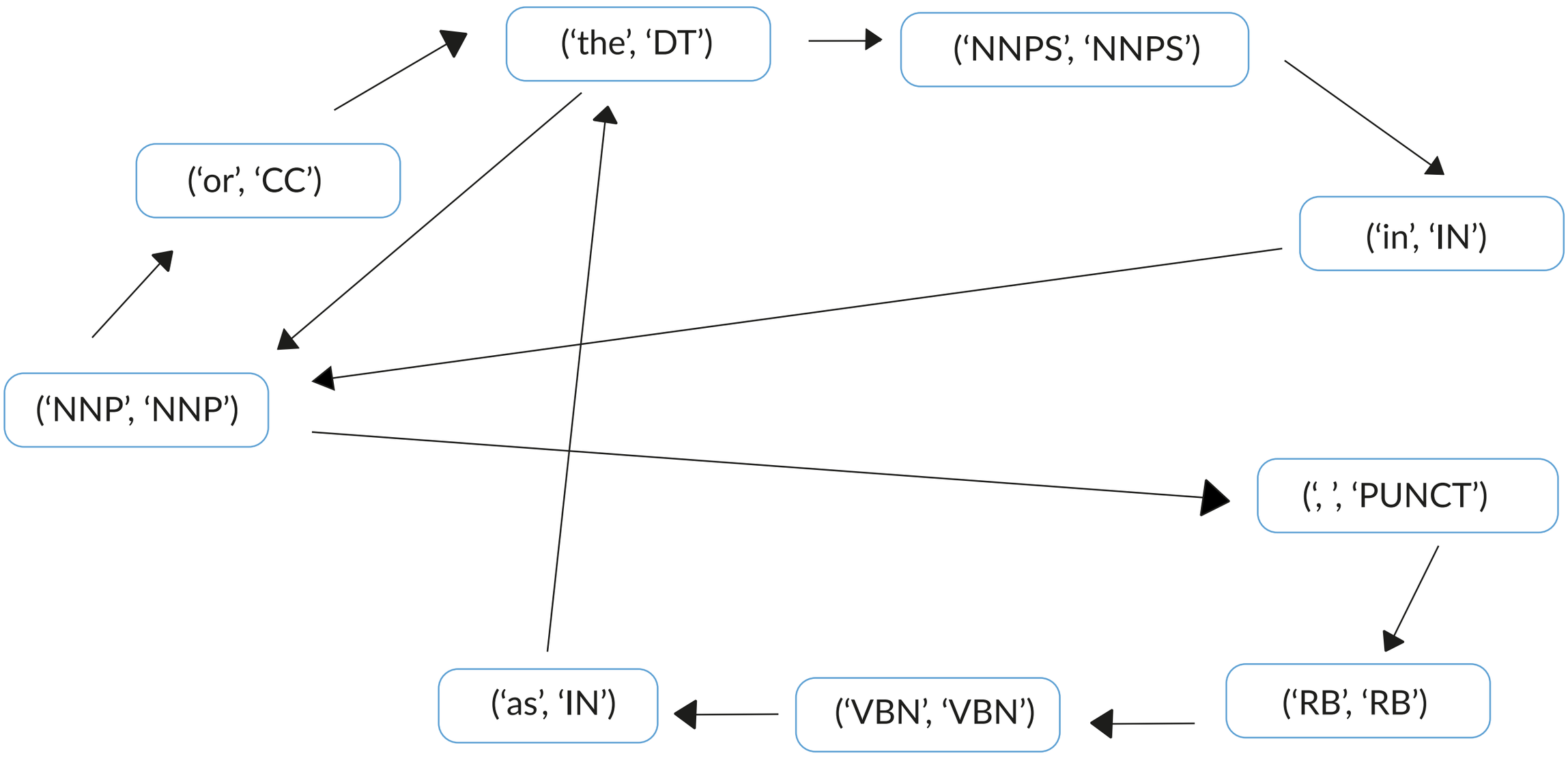

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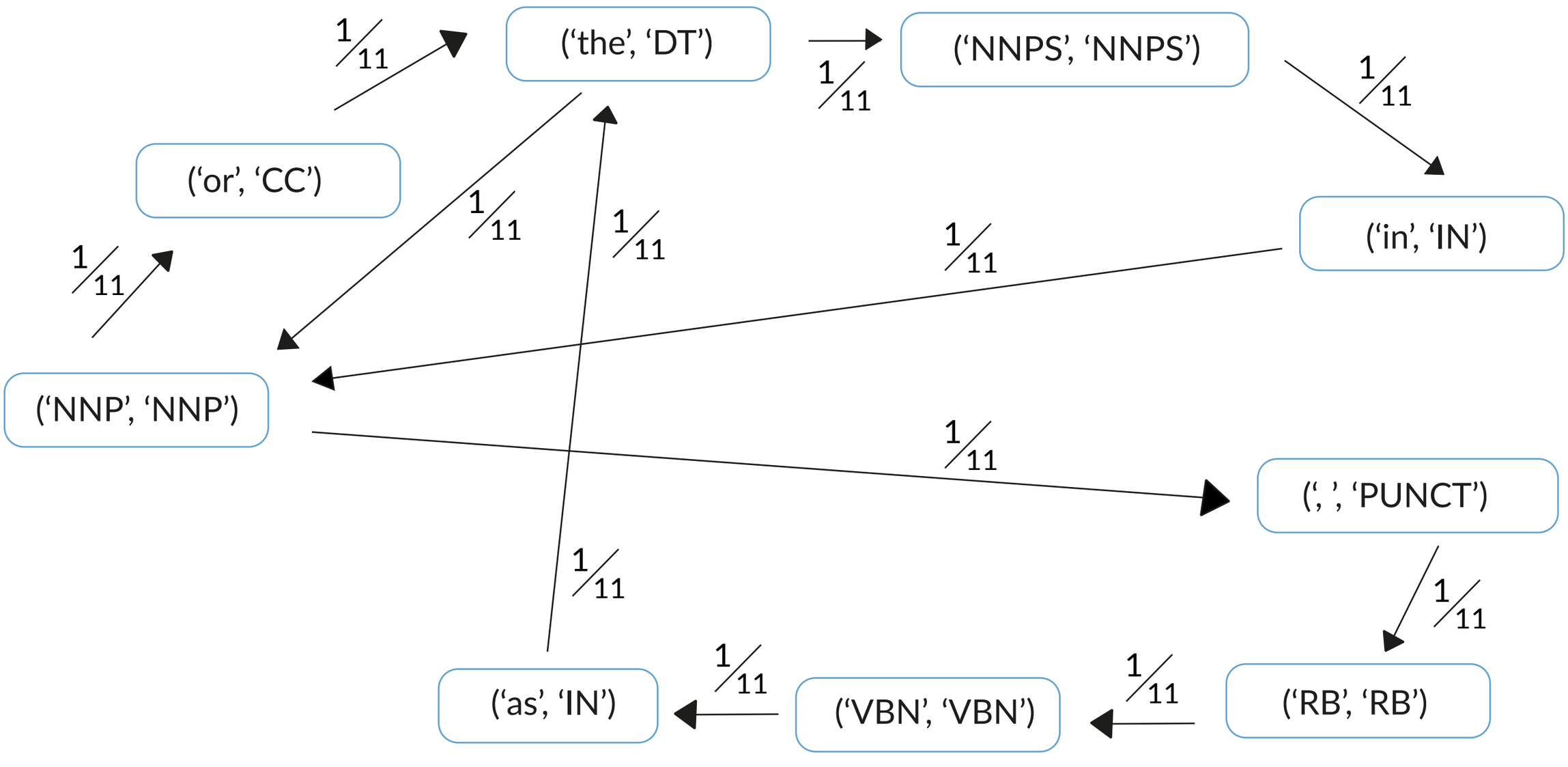

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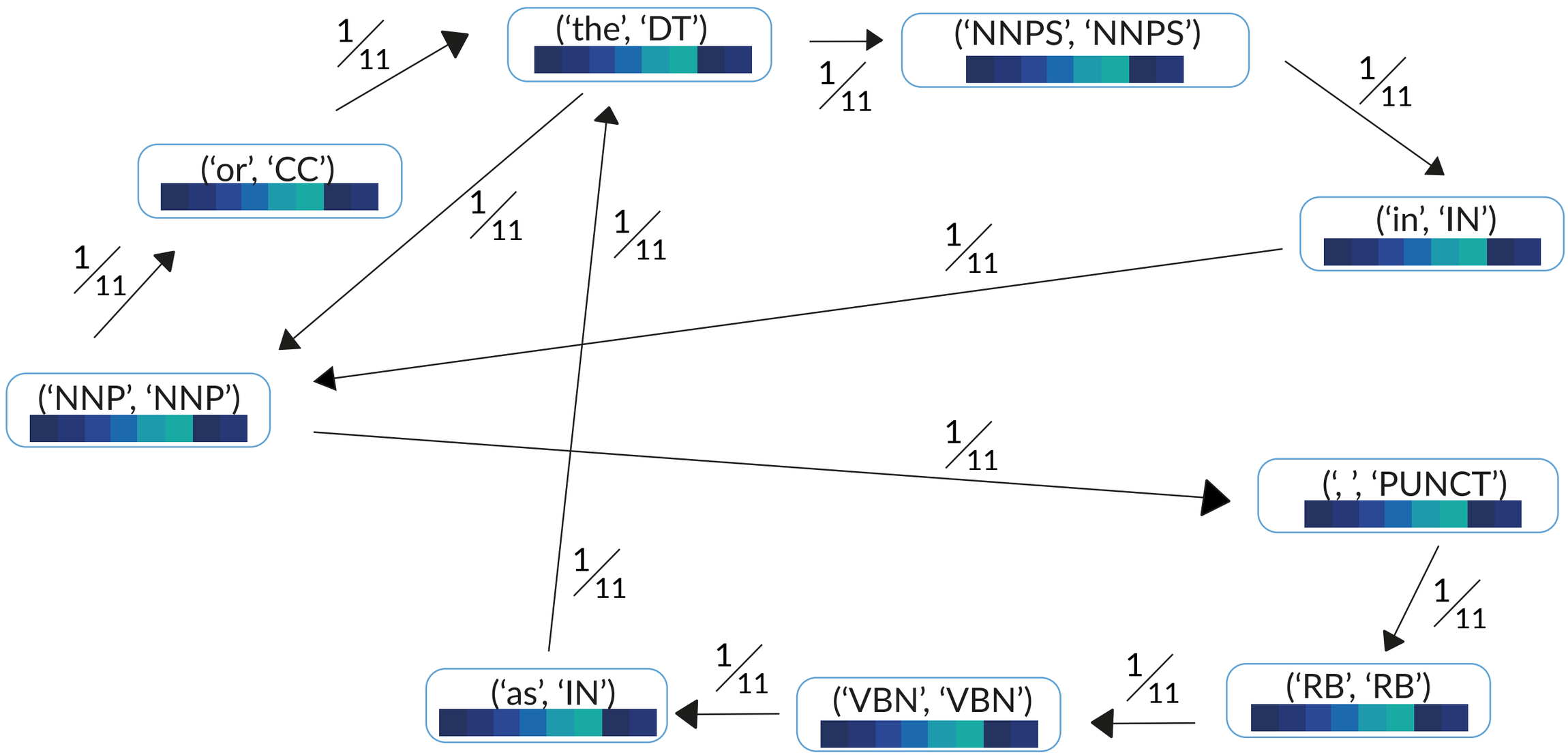
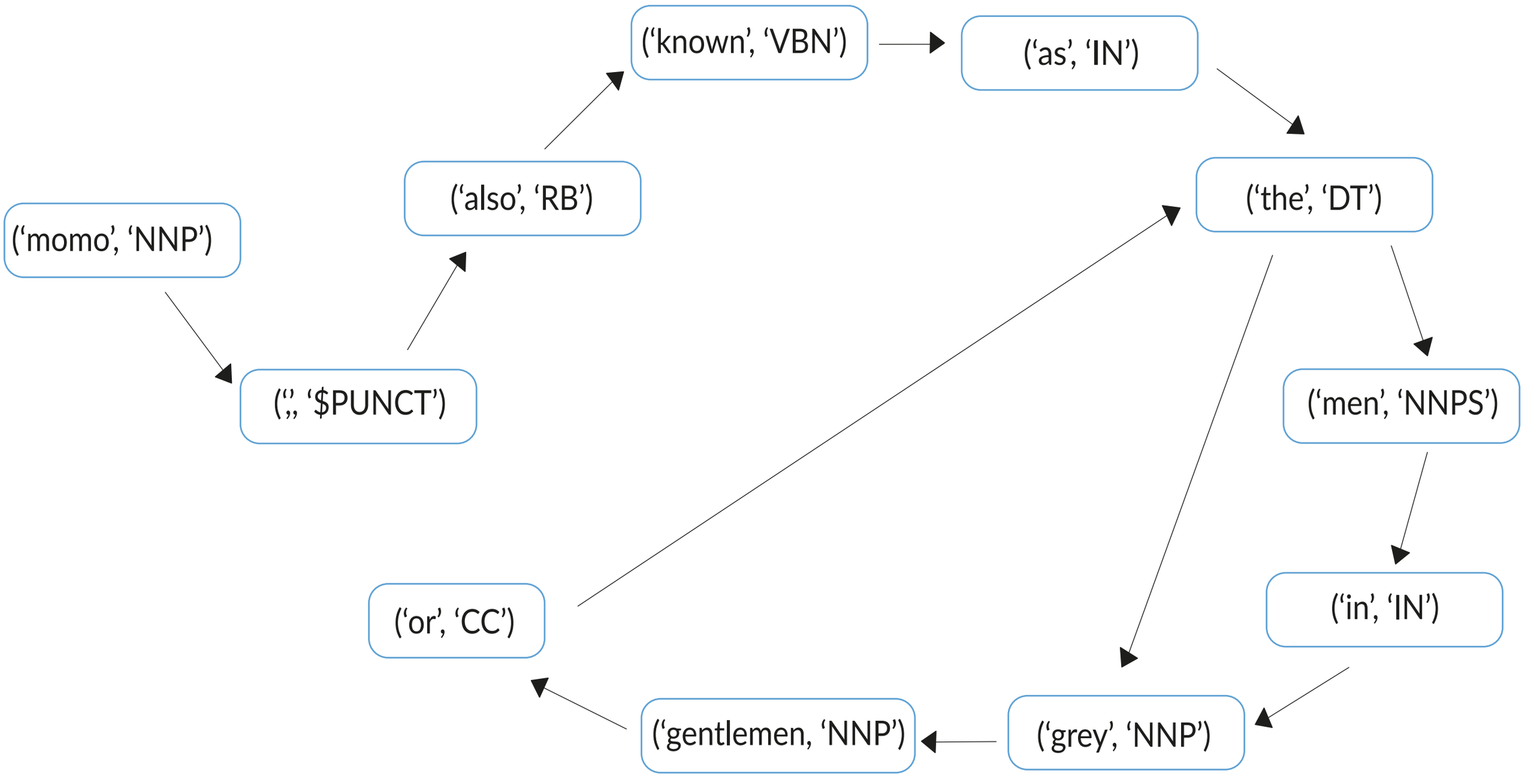


Input: “Momo, also known as The Grey Gentlemen or the Men in Grey

REDUCE_LABELS = { }

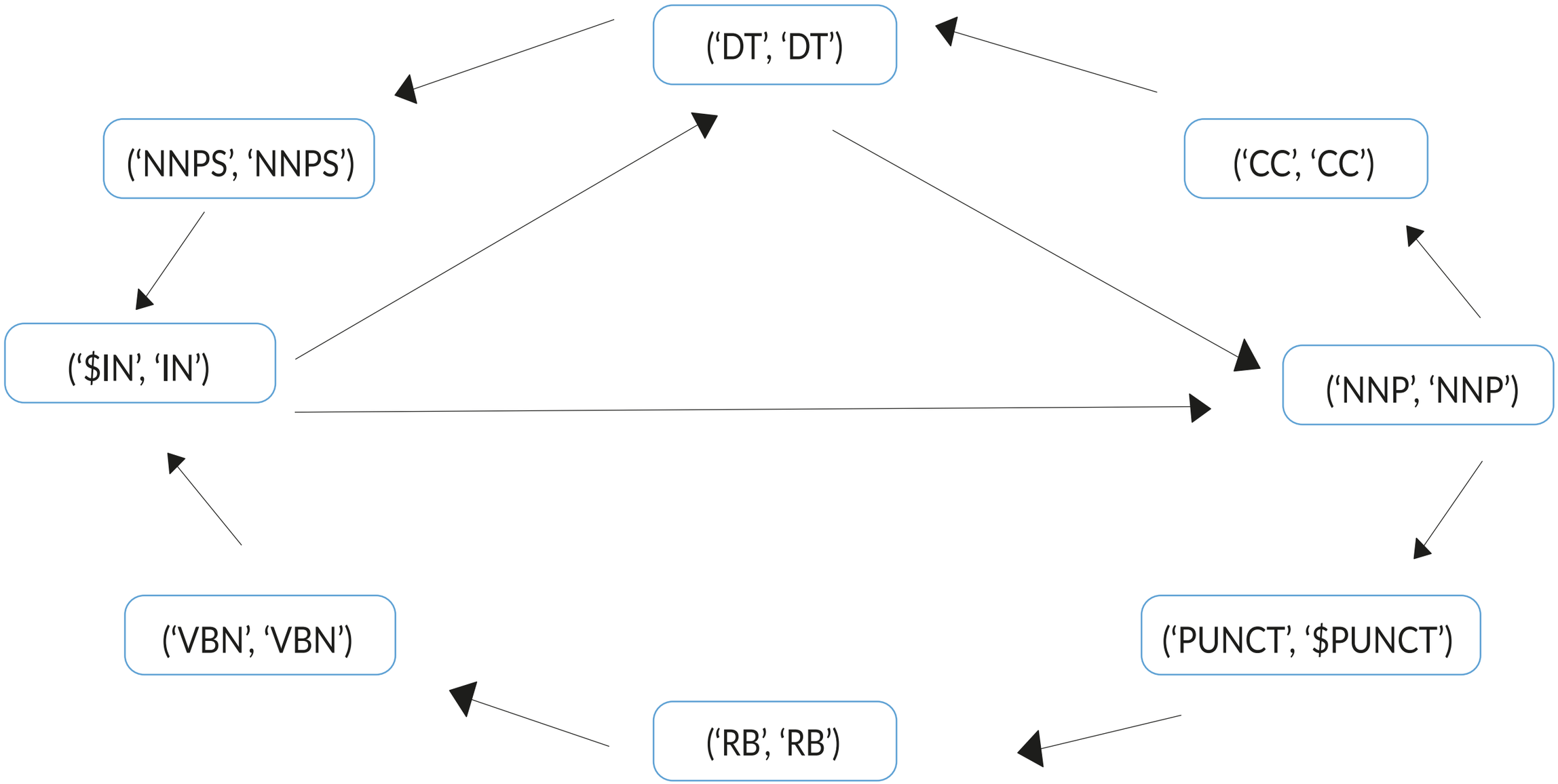
FULL GRAPH (COOCURRENCE)



Input: “Momo, also known as The Grey Gentlemen or the Men in Grey

SHORT GRAPH

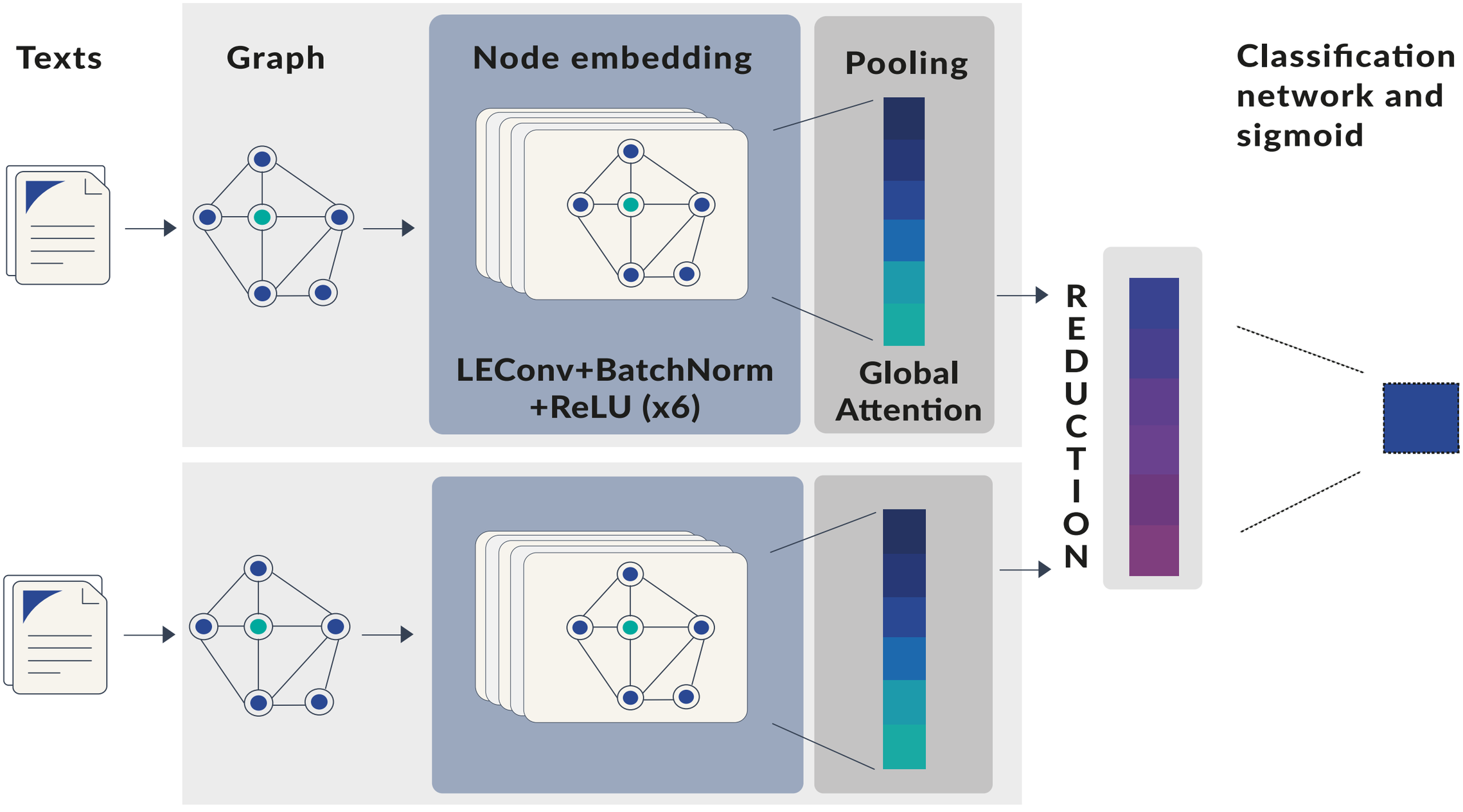
REDUCE_LABELS = ALL LABELS



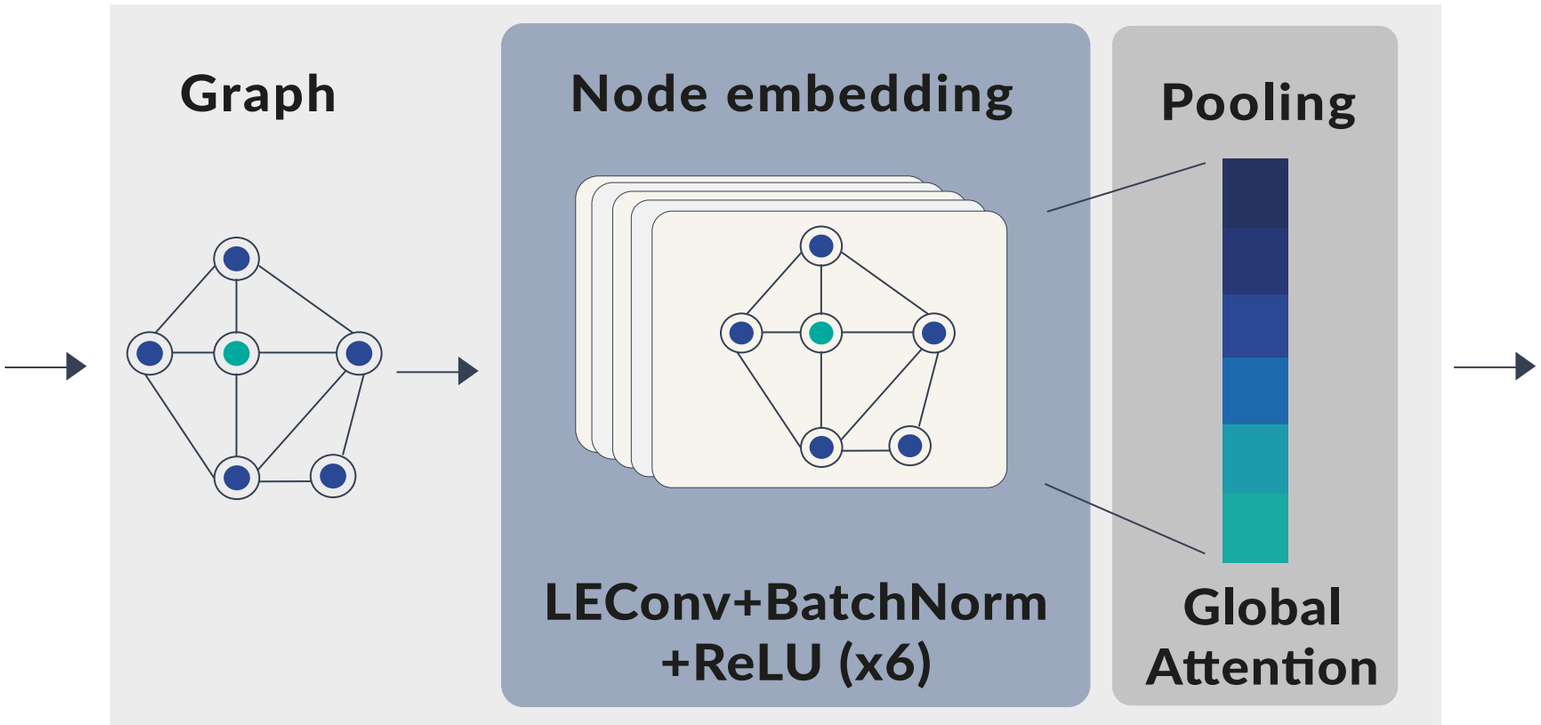
GRAPH SIZE

Nombre	REDUCE_LABELS set	Nodes	Edges
Short	All labels	33	407
Med	Labels corresponding to adjectives, nouns, adverbs, verbs, cardinal numbers, foreign words, list item marker, symbols and others	138	1168
Full	Empty set	1207	3424

GRAPH-BASED SIAMESE NETWORK

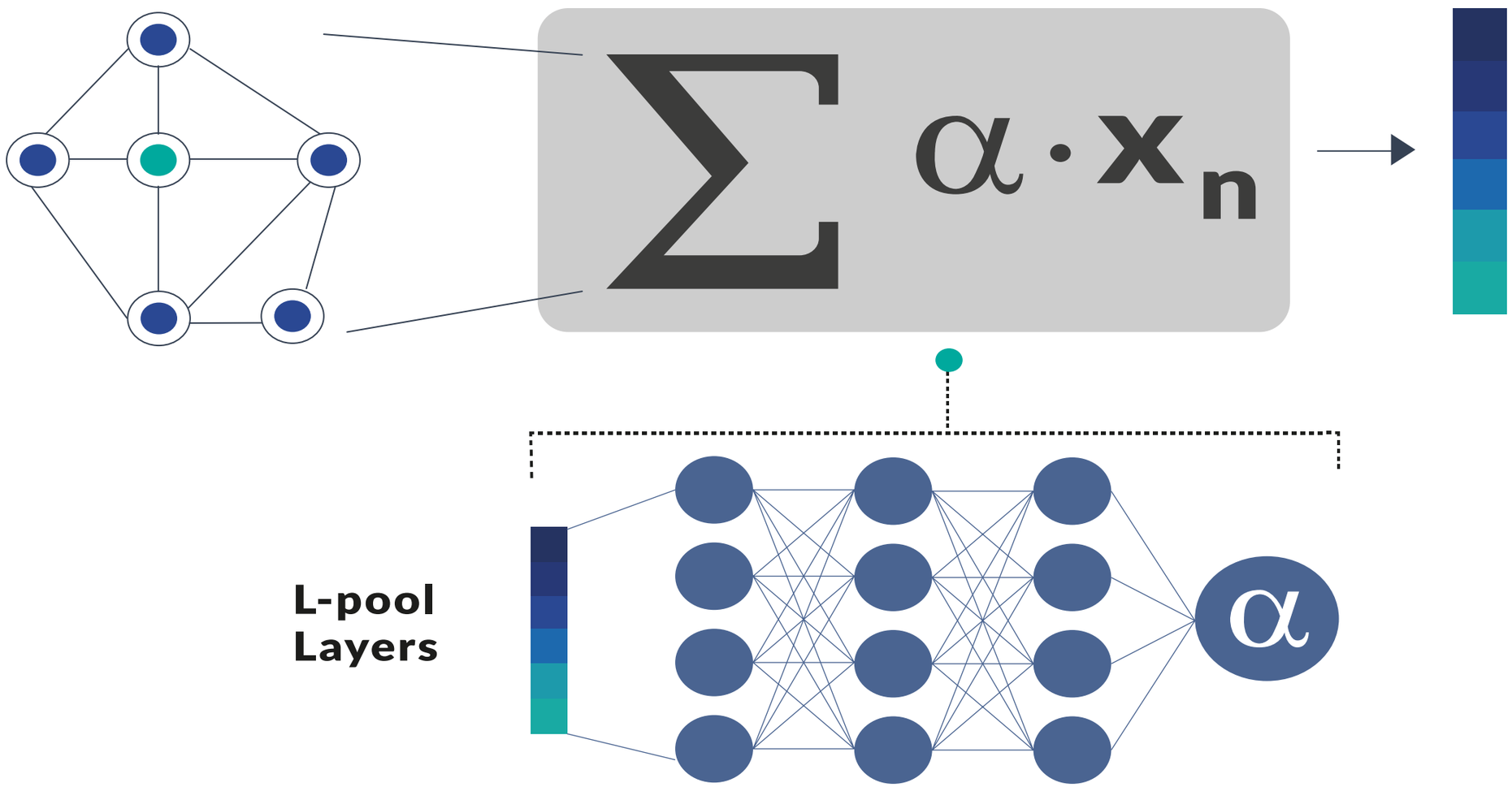


FEATURE EXTRACTION COMPONENTS



* Local Extreme Convolution (LEConv) layer was original proposed in:
E. Ranjan, et al. “ASAP: Adaptative Structure Aware Pooling for Learning Hierarchical Graph Representations”. Thirty-Fourth AAAI Conference on Artificial Intelligence, Feb 2020.

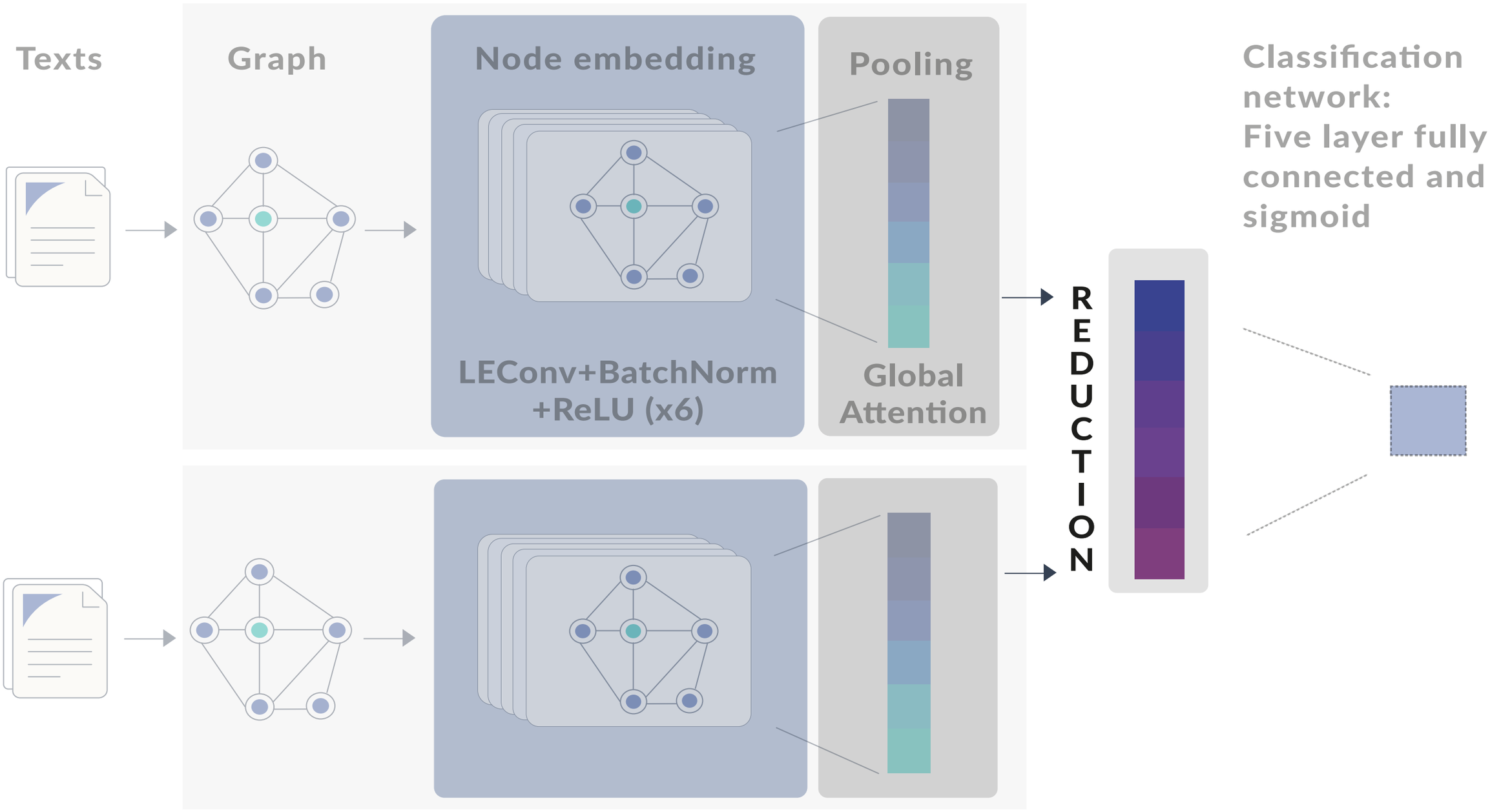
GLOBAL POOLING



* Global pooling layer was original in:

Y. Li, et. al. “Gated Graph Sequence Neural Networks”, Proceedings of ICLR, Sept. 2017.

REDUCTION AND CLASSIFICATION



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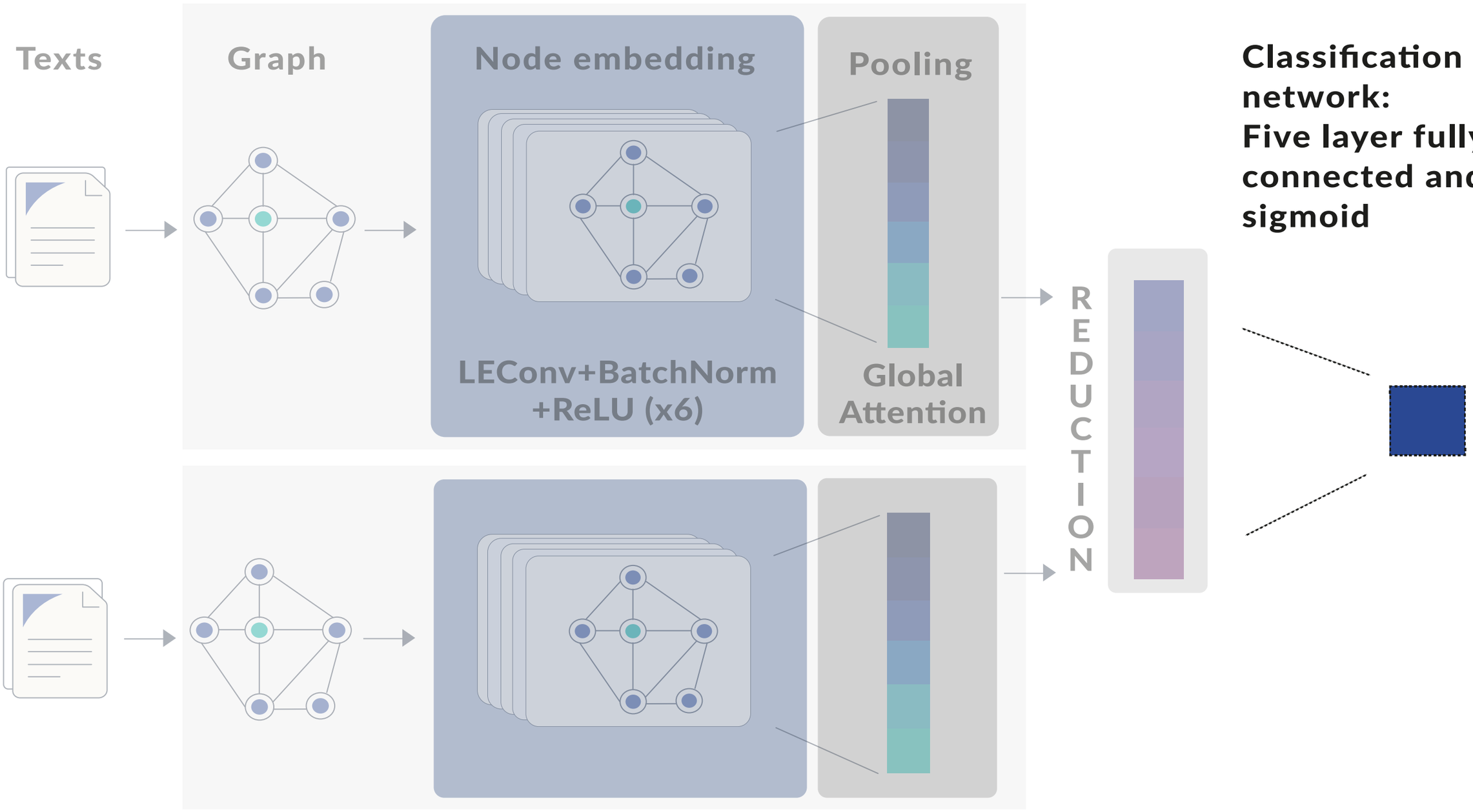
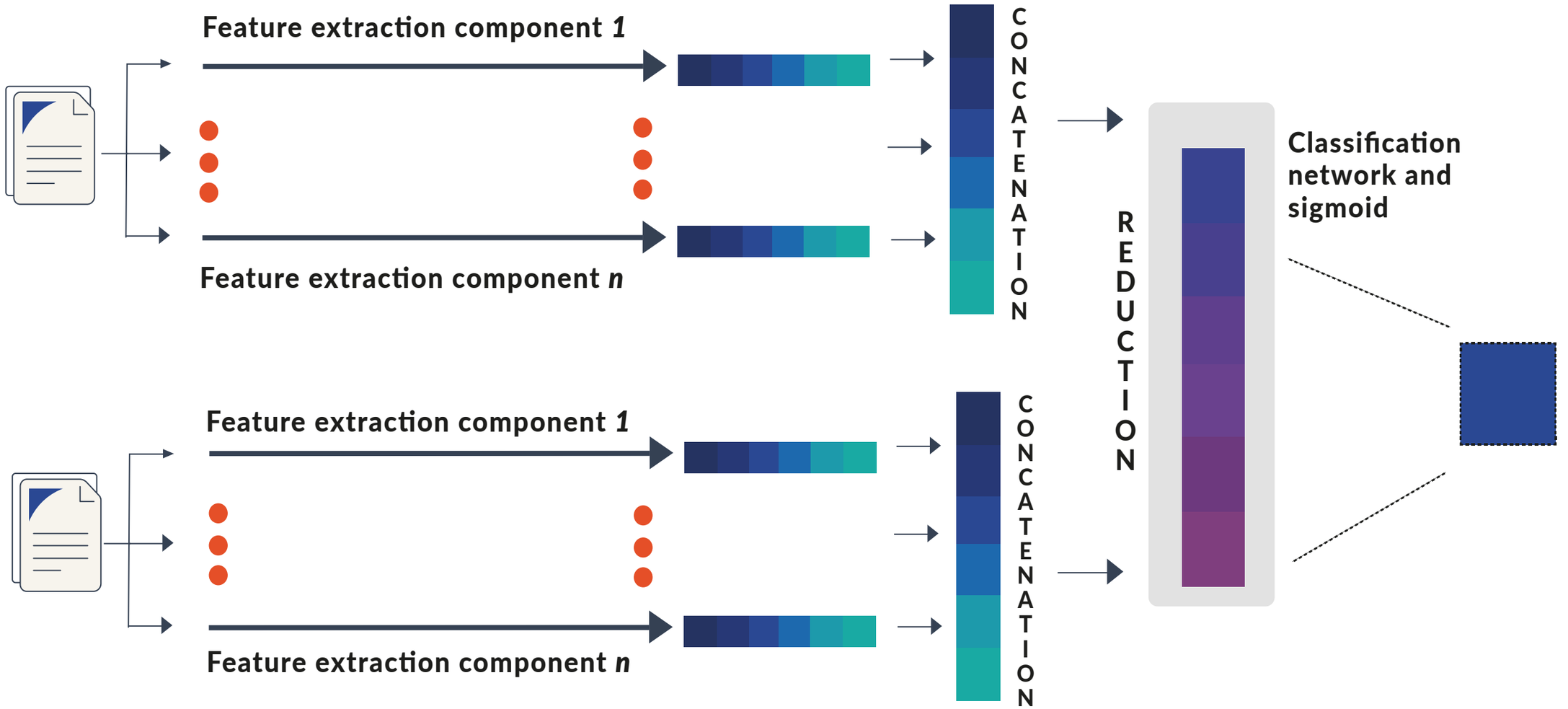


Classification network: Five layer fully connected and sigmoid

GRAPH-BASED SIAMESE NETWORK ENSEMBLE



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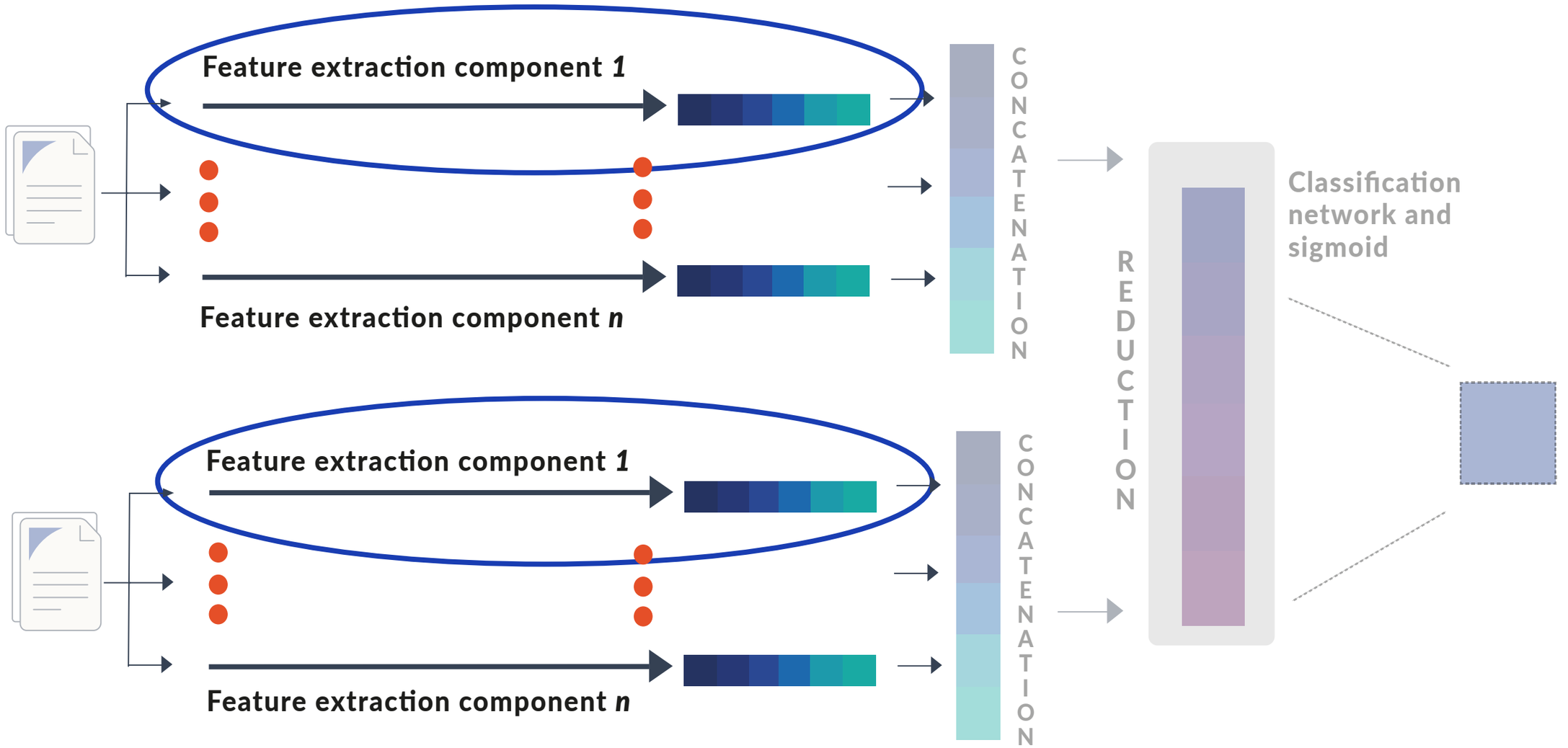

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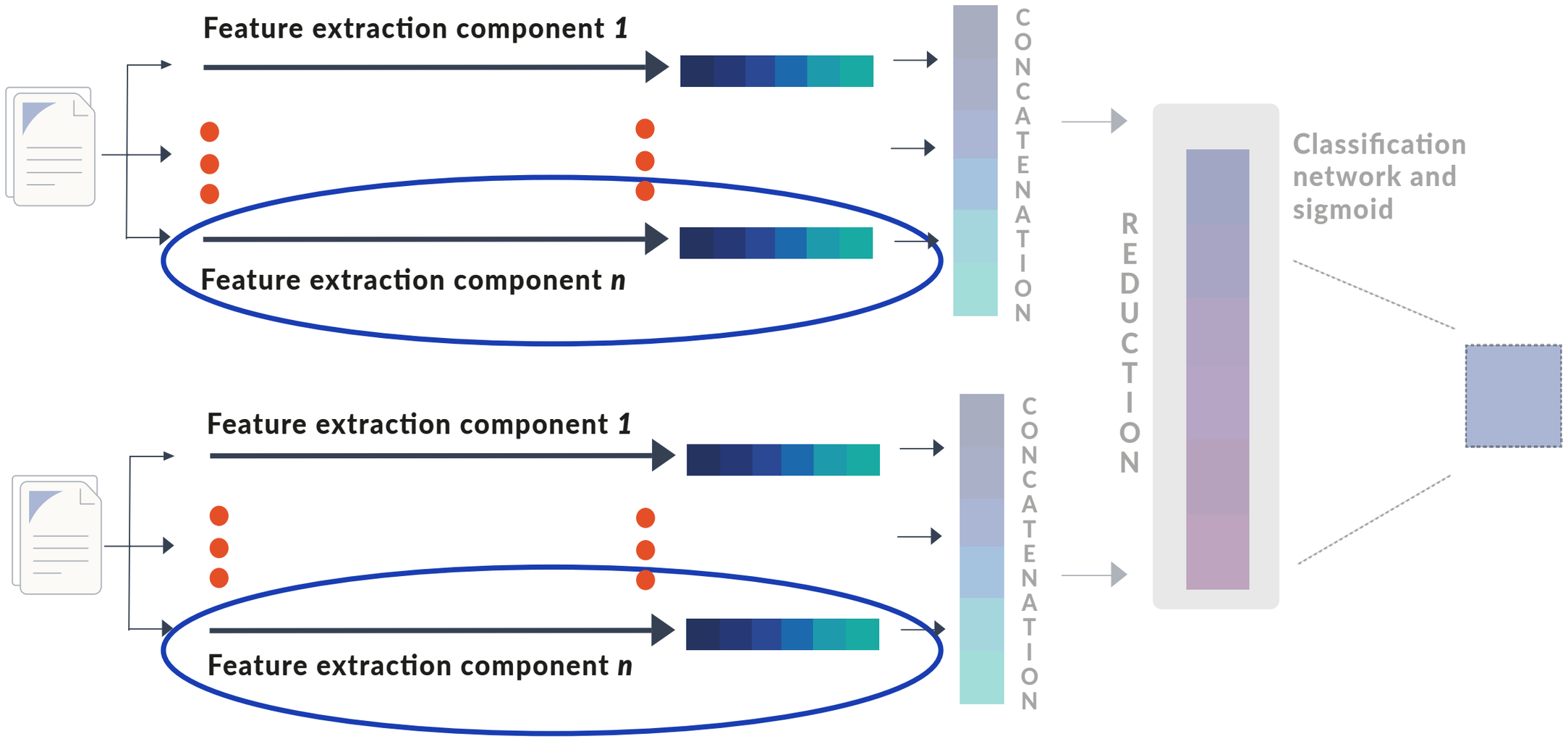

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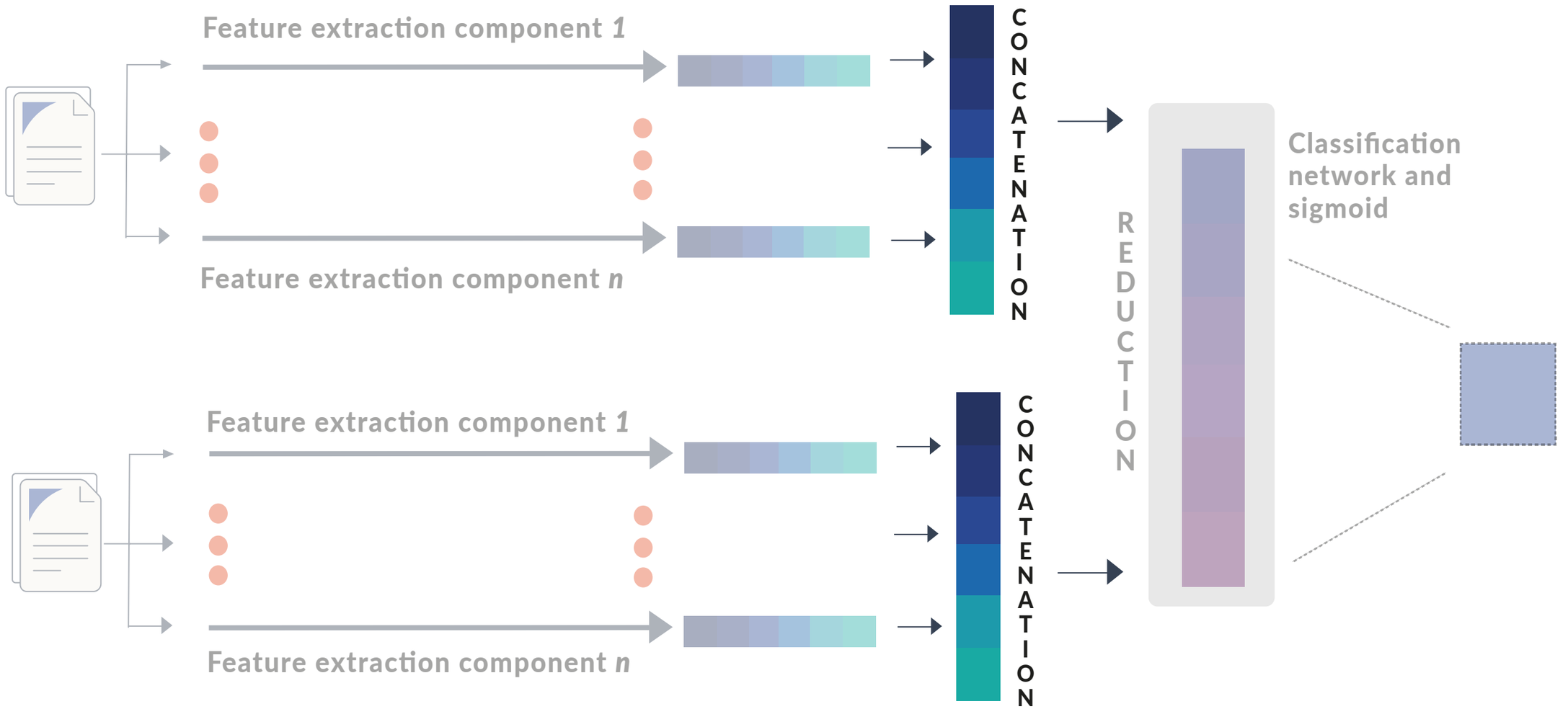
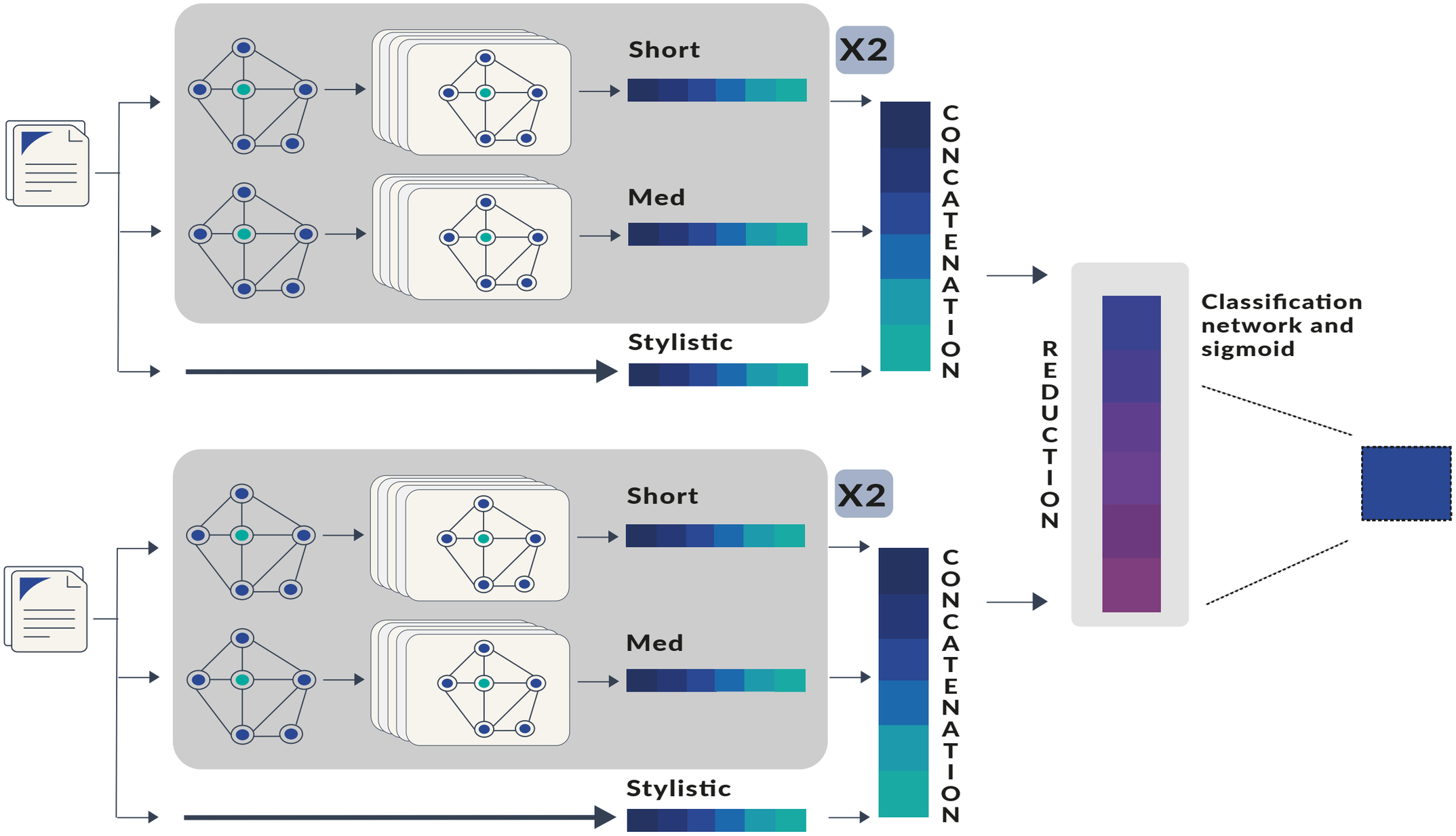


SUBMITTED MODEL

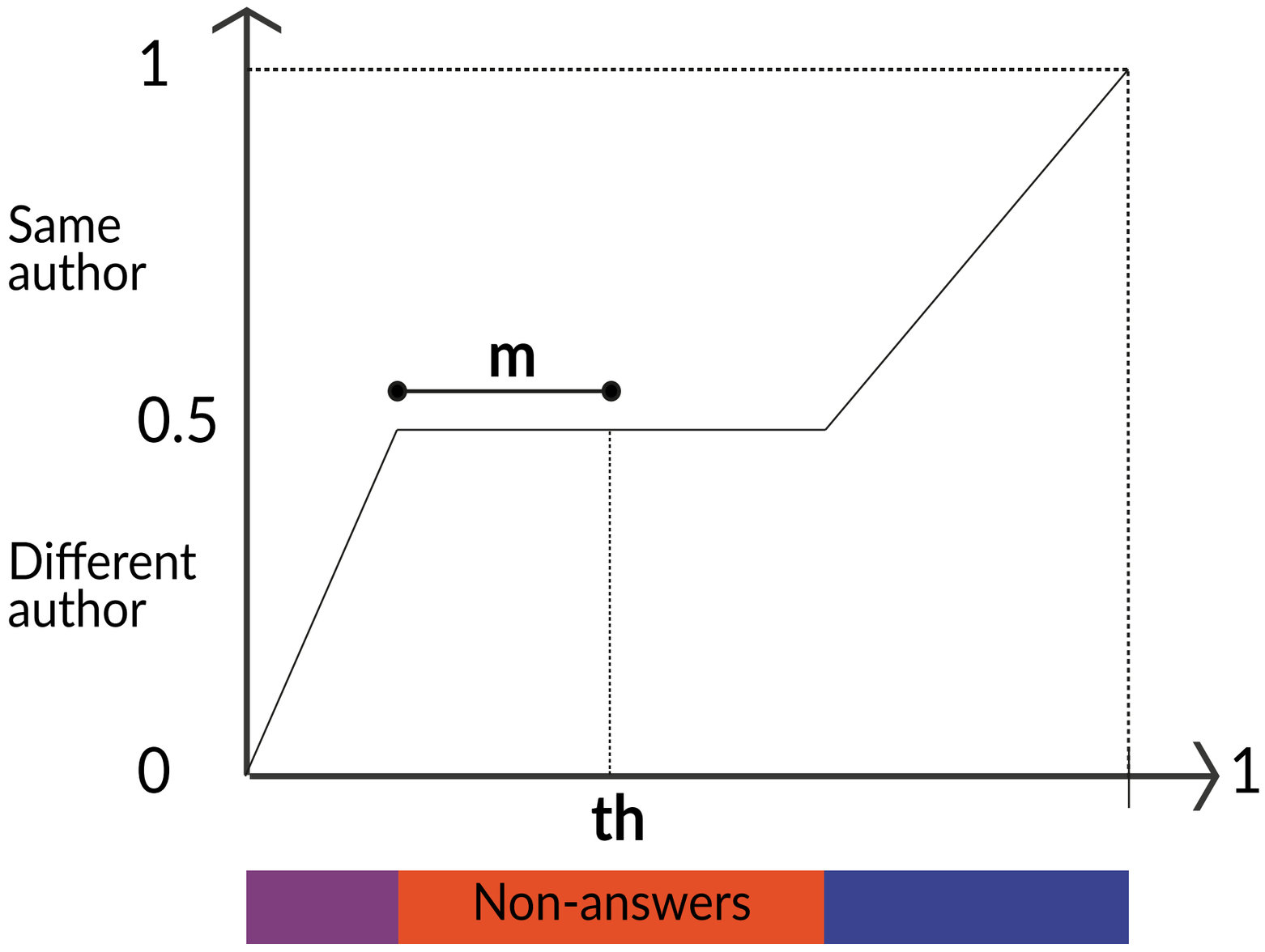


STYLISTIC COMPONENT

- Frequency of **function words**.
- Average number of **characters per word**.
- **Vocabulary richness**.
- Frequency of **words of fixed lenght** (1 to 10 characters).

* Selected from the ones used in:
J Weerasinghe and R. Greenstadt. “Feature Vector Difference based Neural Network and Logistic Regression Models for Authorship Verification”. Notebook for PAN at CLEF 2020, page 6, 2020.

THRESHOLD ADJUSTMENT



th = threshold
m = margin

We perform a grid search to find the best **th** and **v** accordingly to our metrics.

RESULTS

	ARCHITECTURE	SMALL	LARGE
DEVELOPEMENT RESULTS	Short graph component	87.81	90.63
	Meg graph component	88.31	91.50
	Short + Med	89.21	92.38
	Short + Med + Features	89.80	NA
	Short(x2) + Med(x2) + Features (Submitted)	90.03	92.96
FINAL RESULT	Short(x2) + Med(x2) + Features (Submitted)	90.70	93.59

CONCLUSIONS

- We propose a **new approach** to the task, using **graph representations** of the text, **graph neural networks** and **siamese networks**.

- Our models were the **2nd** and **7th** best-evaluated models.

FUTURE WORK

- Evaluate other graph representations (REDUCE_LABEL set).
- Evaluate our approach in other tasks.
- Improve the existing model considering character-level information.

THANK YOU!

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