

# Who am I?

Cristiano De Nobili, Ph.D.



Deep Learning Scientist @ Harman Samsung AI

Machine Learning Instructor @ Deep Learning Italia

- Theoretical Particle Physicist (UniPd)
- Ph.D. in Statistical Physics (SISSA, Trieste)
- Master in High Performance Computing (ICTP)
- Private Pilot Licence 



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Cristiano-De-Nobili

# TEXT UNDERSTANDING FROM SCRATCH

We are going to show you a new and non-standard way to perform text classification.

Cristiano

Intro to DL for Text. Char-level set up. Temporal CNN.

Daniele

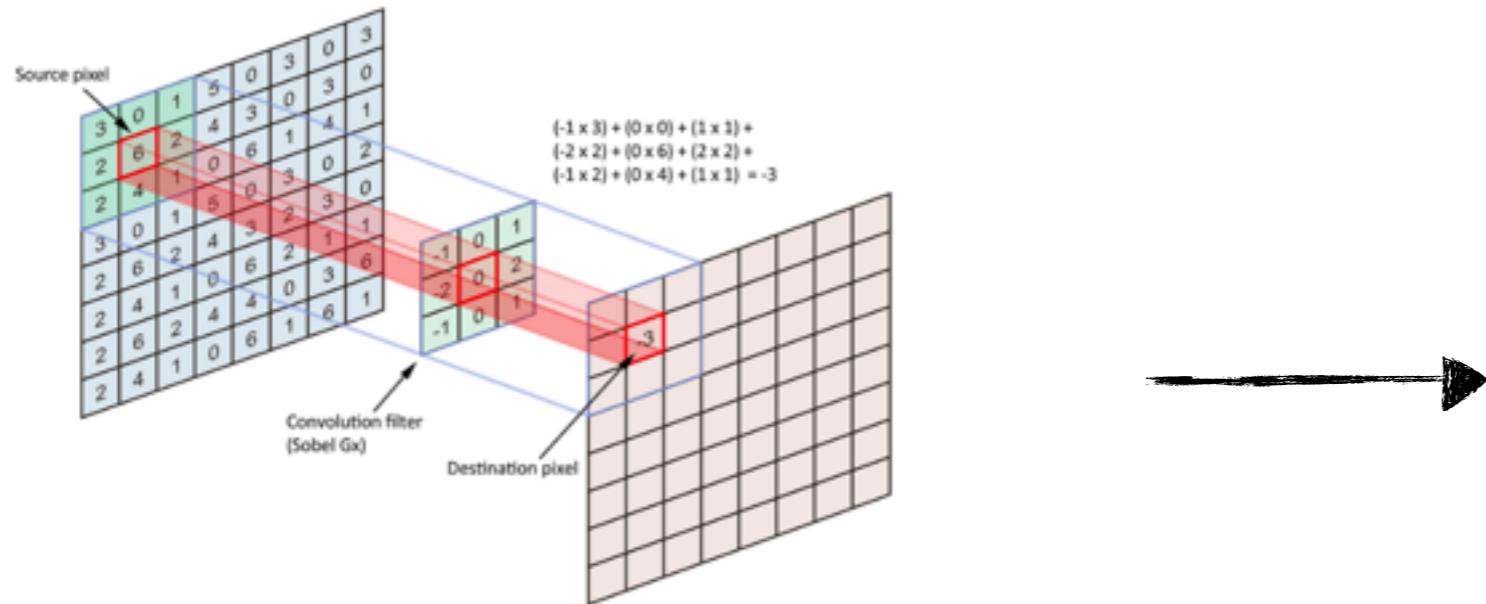
Preliminary results using char-level VDCNNs

Elena

Comparison with FastText

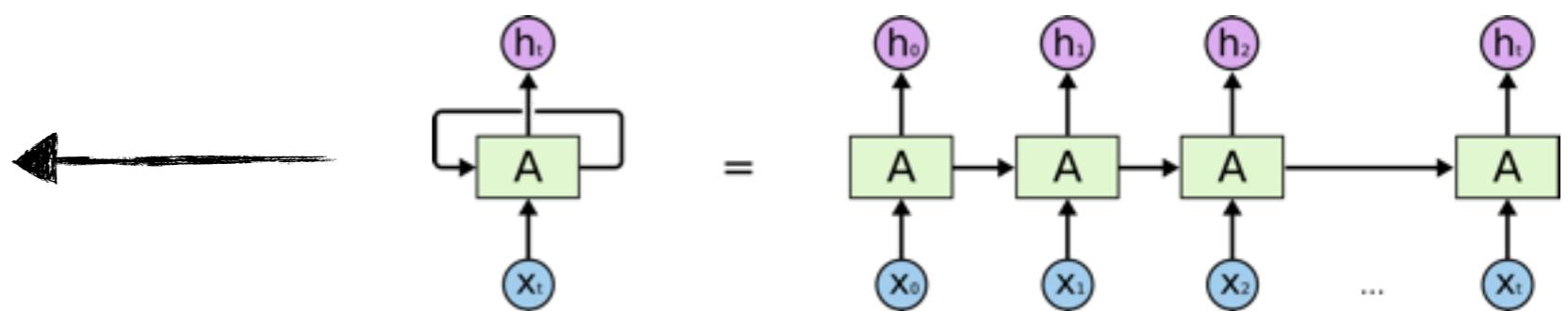
- [1] Text Understanding from Scratch - X. Zhang, Y. LeCun
- [2] Character-level CNNs for Text Classification - X. Zhang, J. Zhao, Y. LeCun
- [3] Very Deep CNNs for Text Classification - A. Conneau, H. Schwenk, Y. LeCun, L. Barrault

# There is a belief in DL...



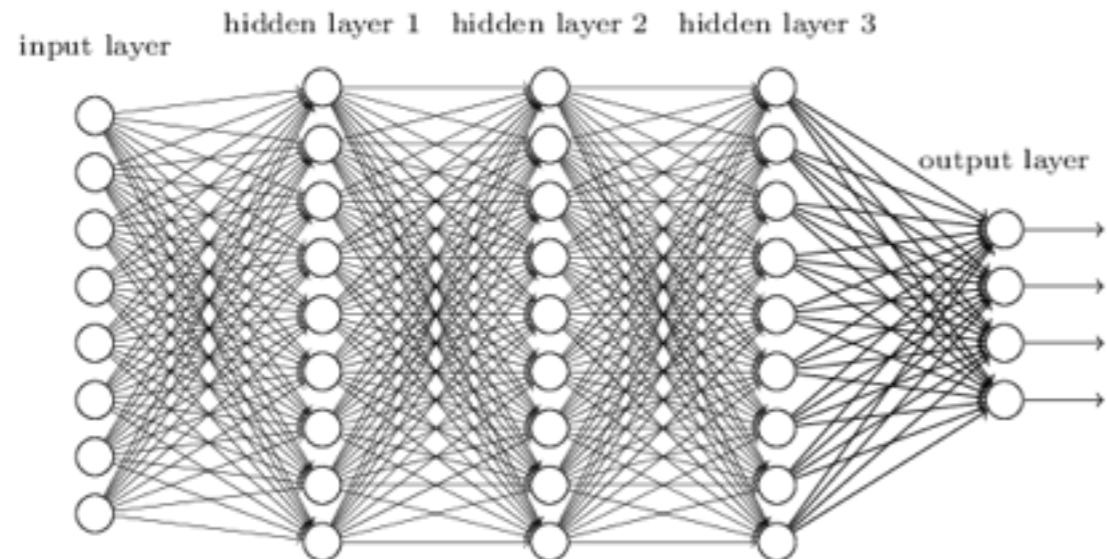
Computer  
Vision

NLP



# From FC to CNNs

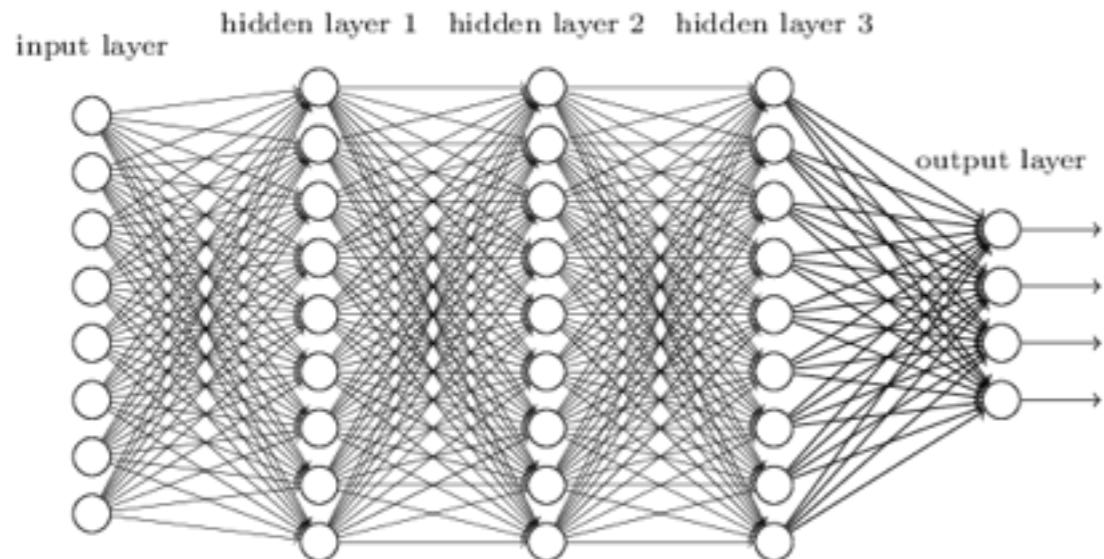
(thanks to symmetries)



$$H[i, j] = \sum_{k, l} W[i, j, k, l] X[k, l]$$

# From FC to CNNs

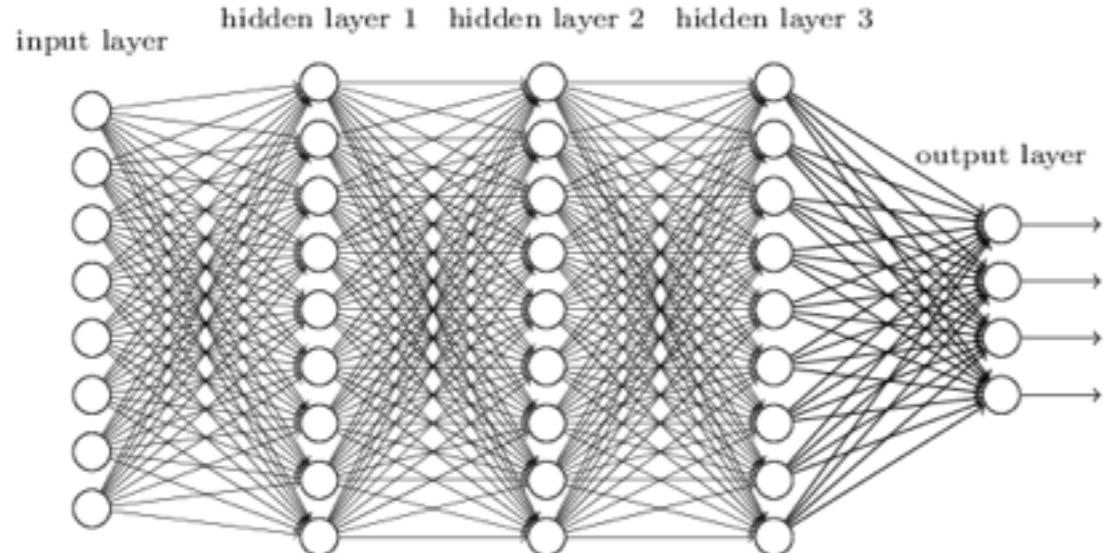
(thanks to symmetries)



$$H[i, j] = \sum_{a,b} K[i, j, a, b] X[i + a, j + b]$$

# From FC to CNNs

(thanks to symmetries)



Fully Connected...

$$H[i, j] = \sum_{a,b} K[i, j, a, b] X[i + a, j + b]$$

Translational Invariance:

$$K[i, j, a, b] = K[a, b]$$

$$H[i, j] = \sum_{a,b} K[a, b] X[i + a, j + b]$$

Locality:

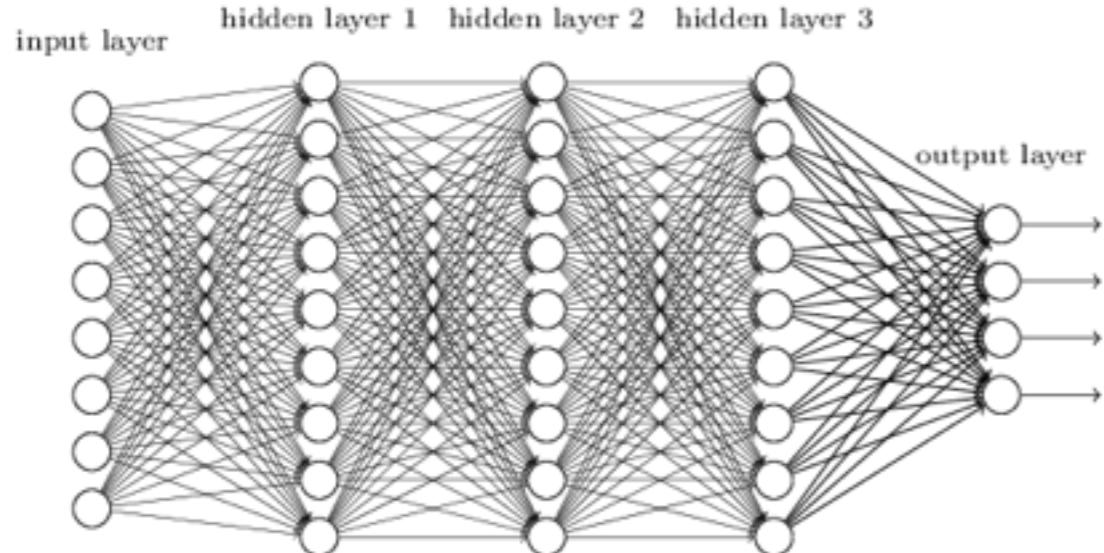
$$K[a, b] = 0$$

(outside some range)

$$H[i, j] = \sum_{a,b=-\Delta}^{\Delta} K[a, b] X[i + a, j + b]$$

# From FC to CNNs

(thanks to symmetries)



Fully Connected...

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(outside some range)

$$H[i, j] = \sum_{a,b=-\Delta}^{\Delta} K[a, b] X[i + a, j + b]$$

**It's a convolution!!**

# Recurrent Neural Networks

Siamo fatti di  
sorrisi e silenzi,  
sorrisi e silenzi.

I primi vincono,  
i secondi passano.

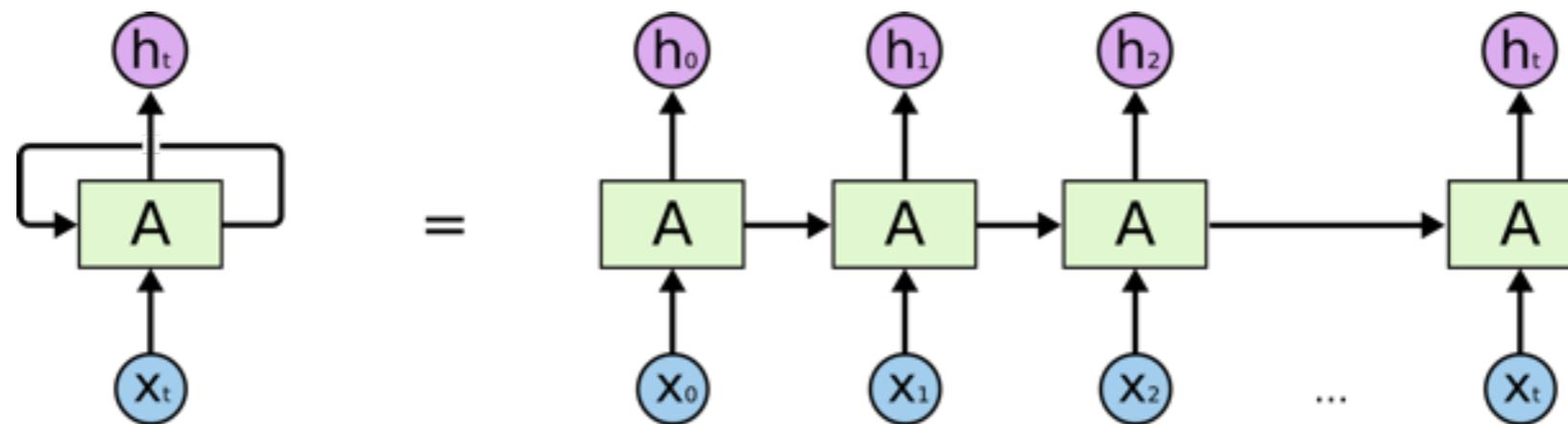
# Recurrent Neural Networks

Siamo fatti di  
**sorrisi e silenzi,**  
sorrisi e silenzi.  
**I primi vincono,**  
**i secondi passano.**

short-range and long-range dependencies !

# Recurrent Neural Networks

"La principale funzione della memoria è dimenticare"



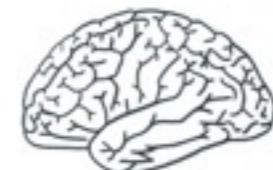
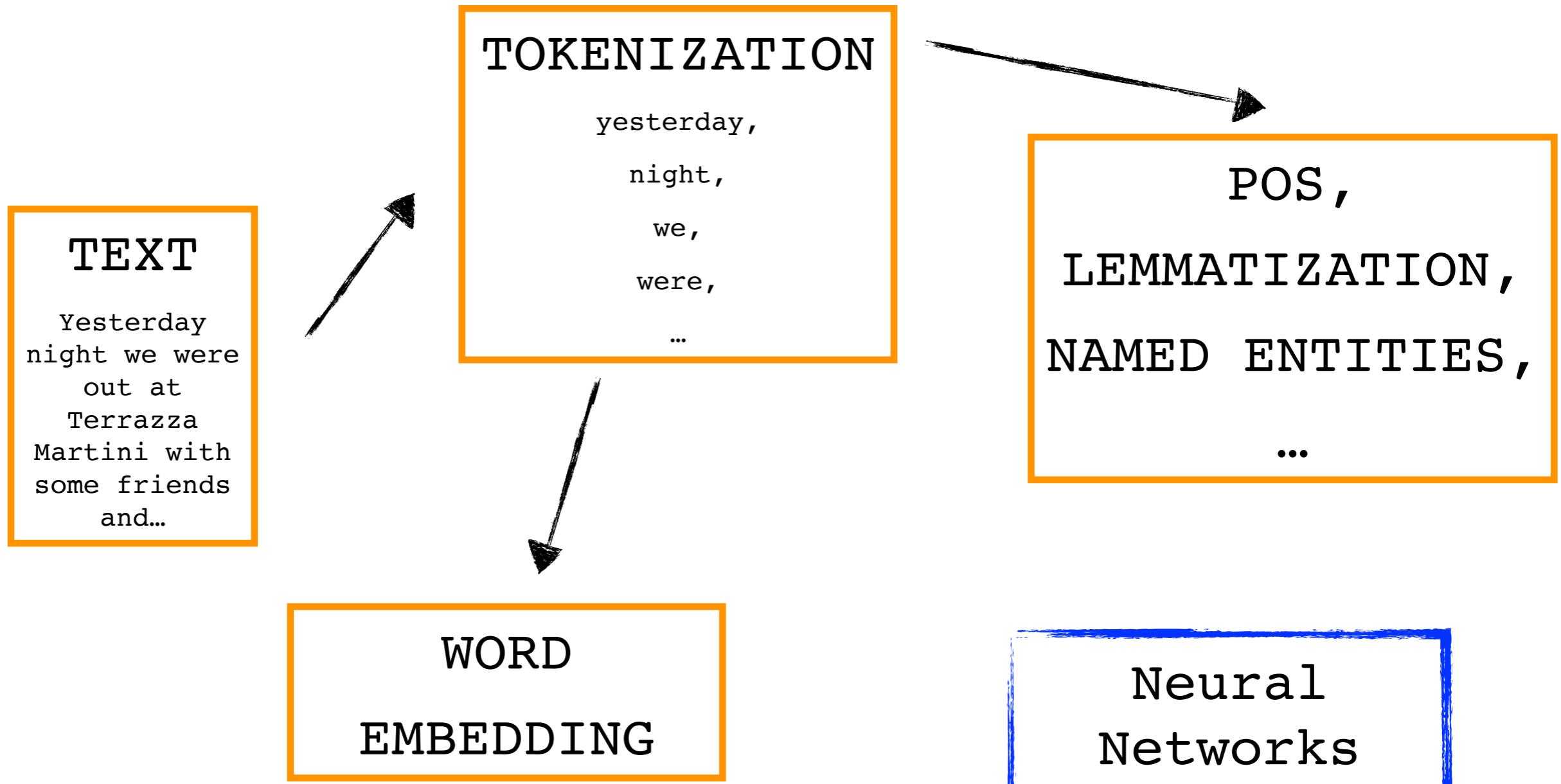
ciao giulia, come stai?



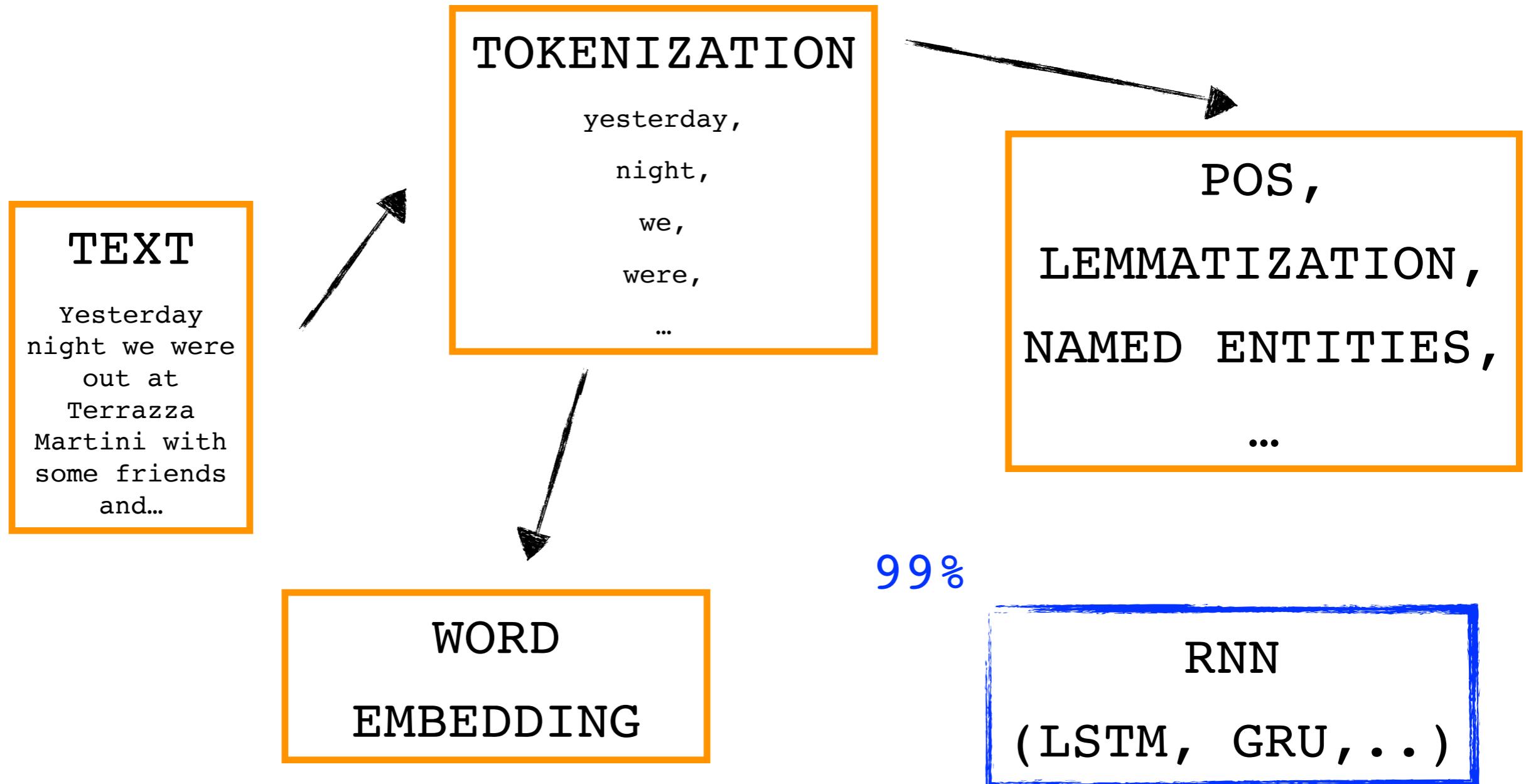
giulia, ti vedo triste. Come mai?



# STANDARD TEXT PIPELINE

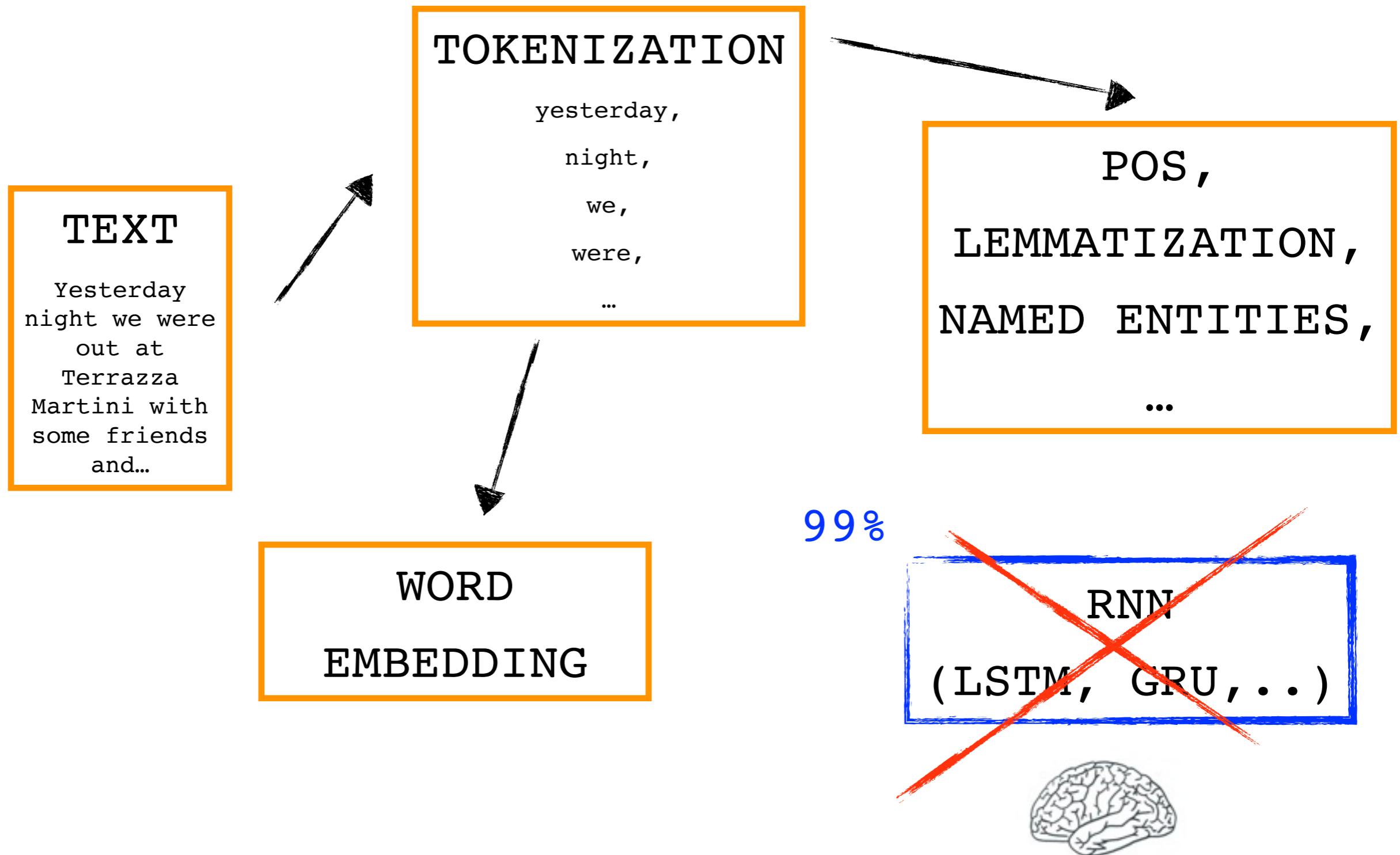


# STANDARD TEXT PIPELINE



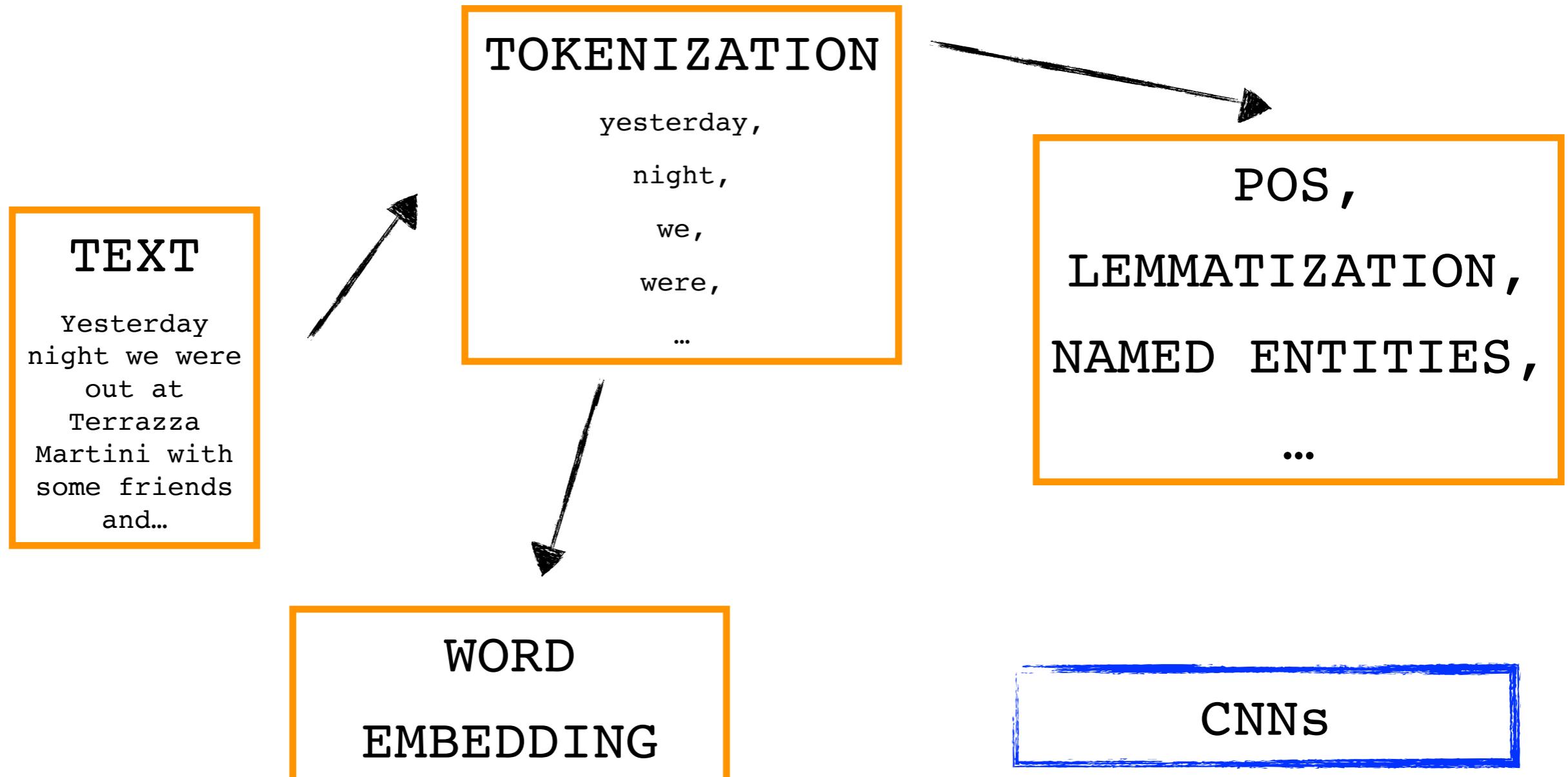
NON

## STANDARD TEXT PIPELINE



NON

## STANDARD TEXT PIPELINE

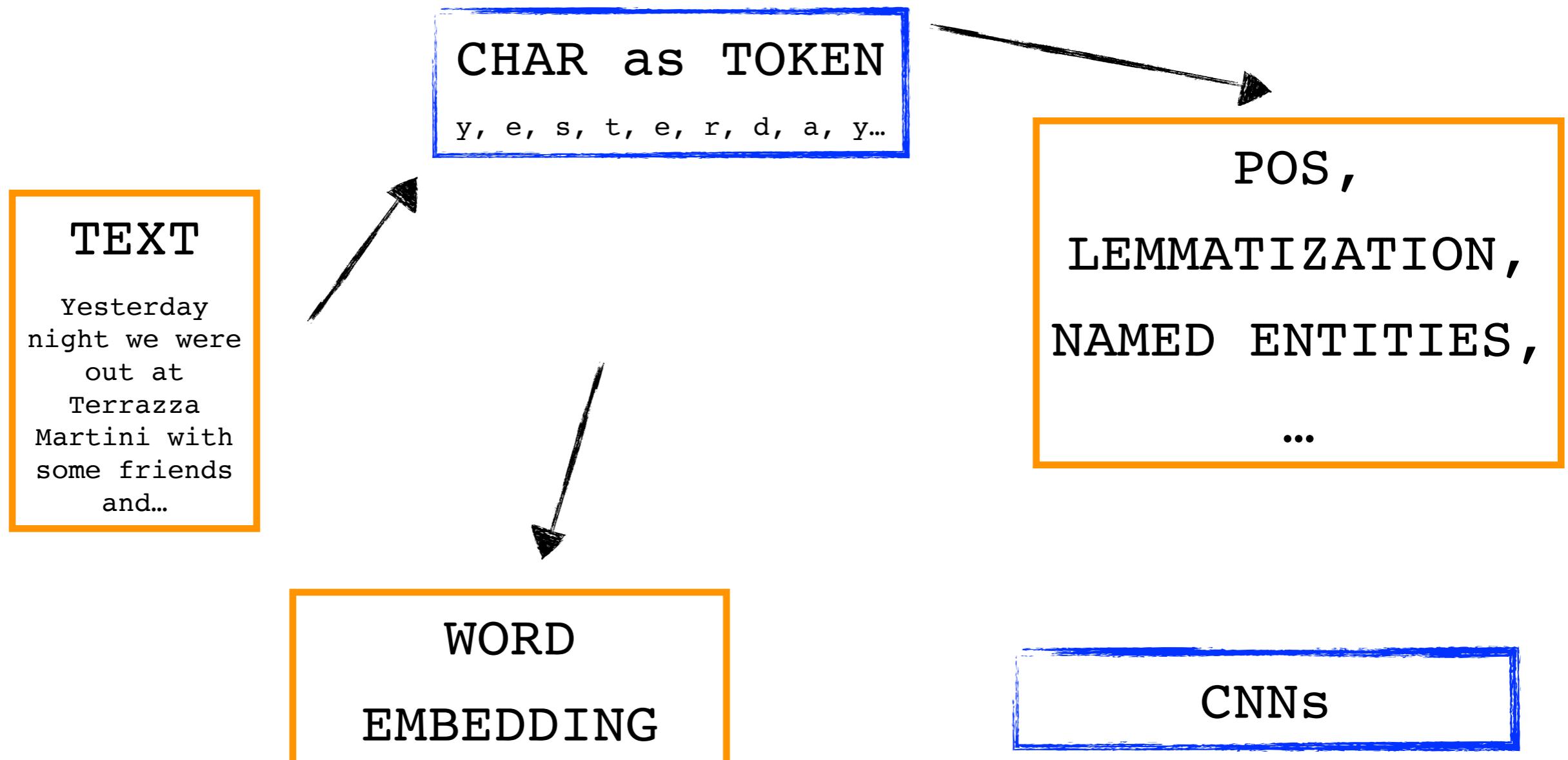


CNNs can be applied to WE without any knowledge on syntactic or semantic structures



NON

## STANDARD TEXT PIPELINE

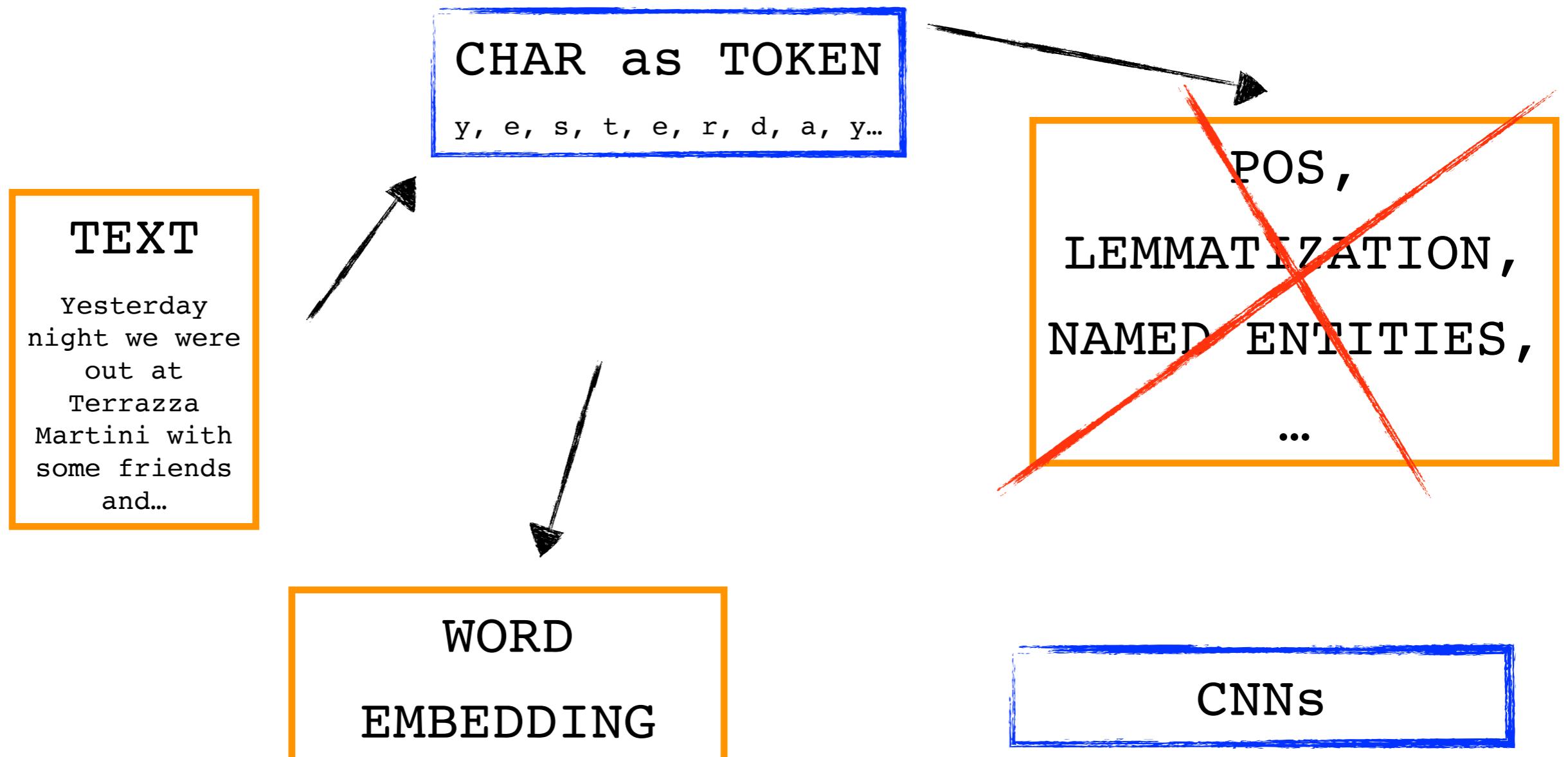


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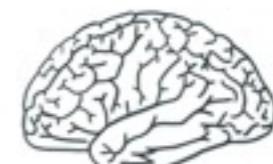


NON

## STANDARD TEXT PIPELINE

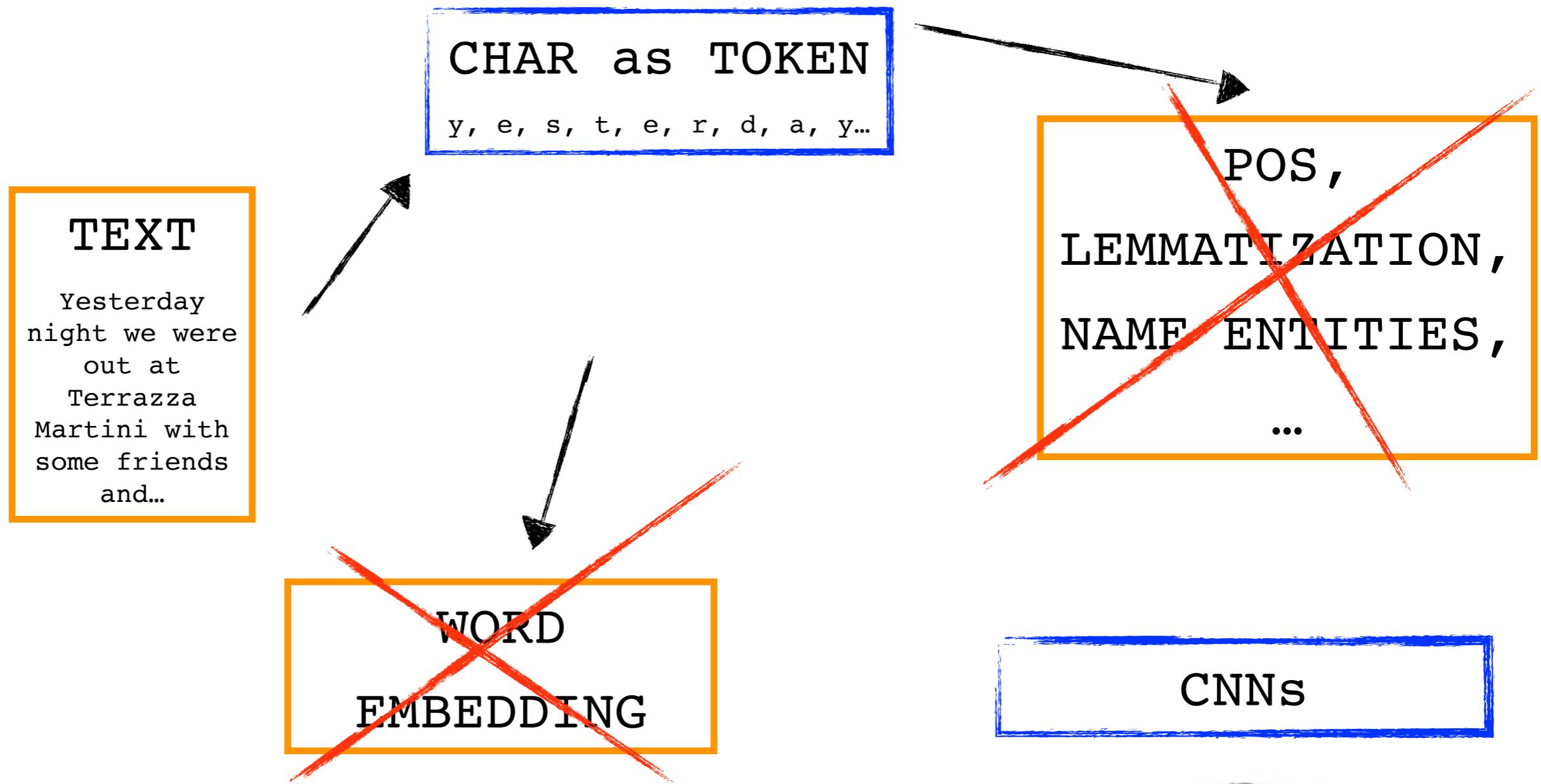


CNNs can be applied to WE without any  
knowledge on syntactic or semantic structures



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## STANDARD TEXT PIPELINE



CNNs can be applied to WE without any  
knowledge on syntactic or semantic structures



NON

## STANDARD TEXT PIPELINE



VDCNNs not only do not require  
any knowledge on syntactic or semantic structures,  
but they also not require  
any knowledge on words (WE).

# TEXT UNDERSTANDING FROM SCRATCH



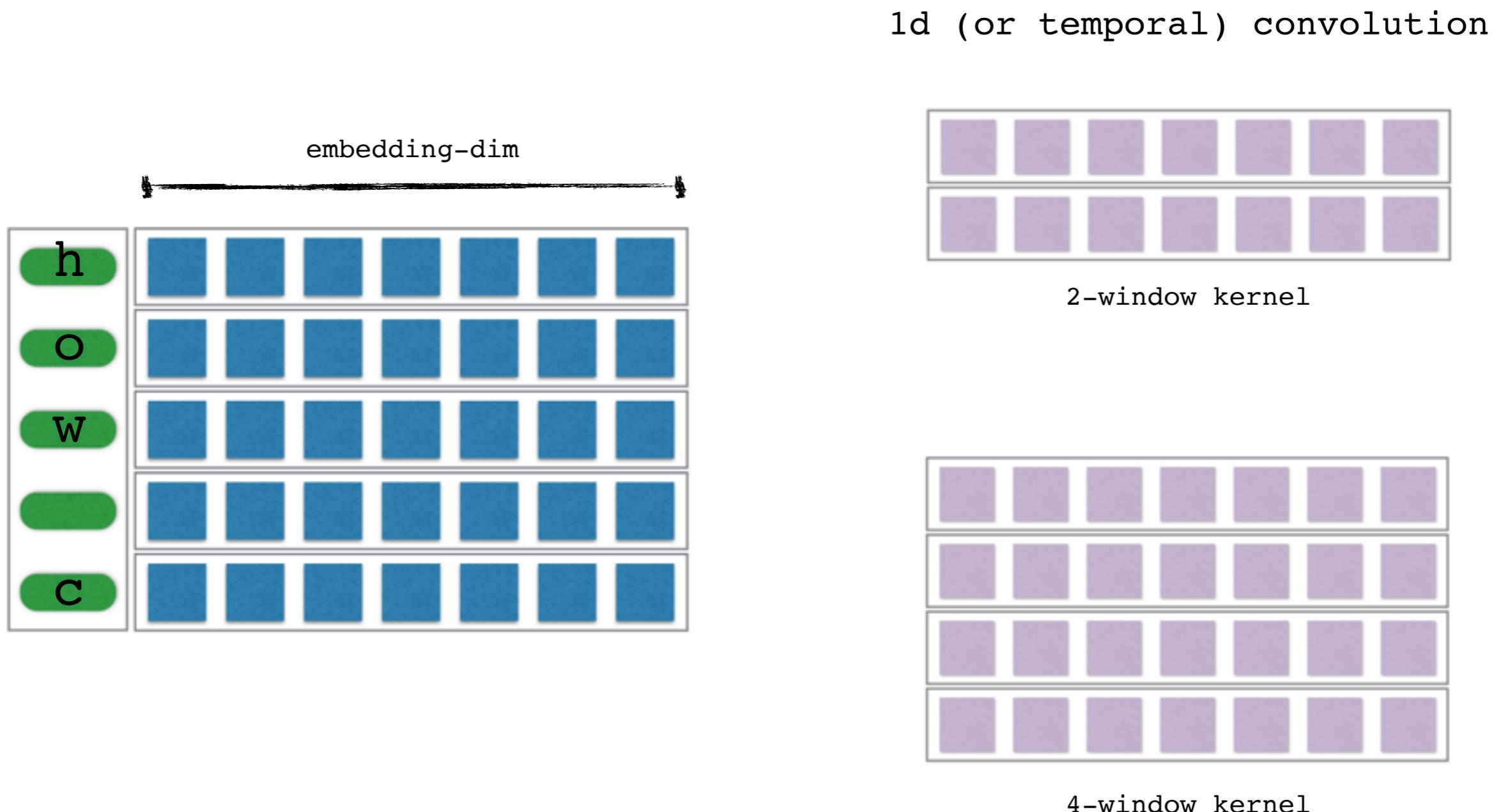
No knowledge of semantics, syntactics

&

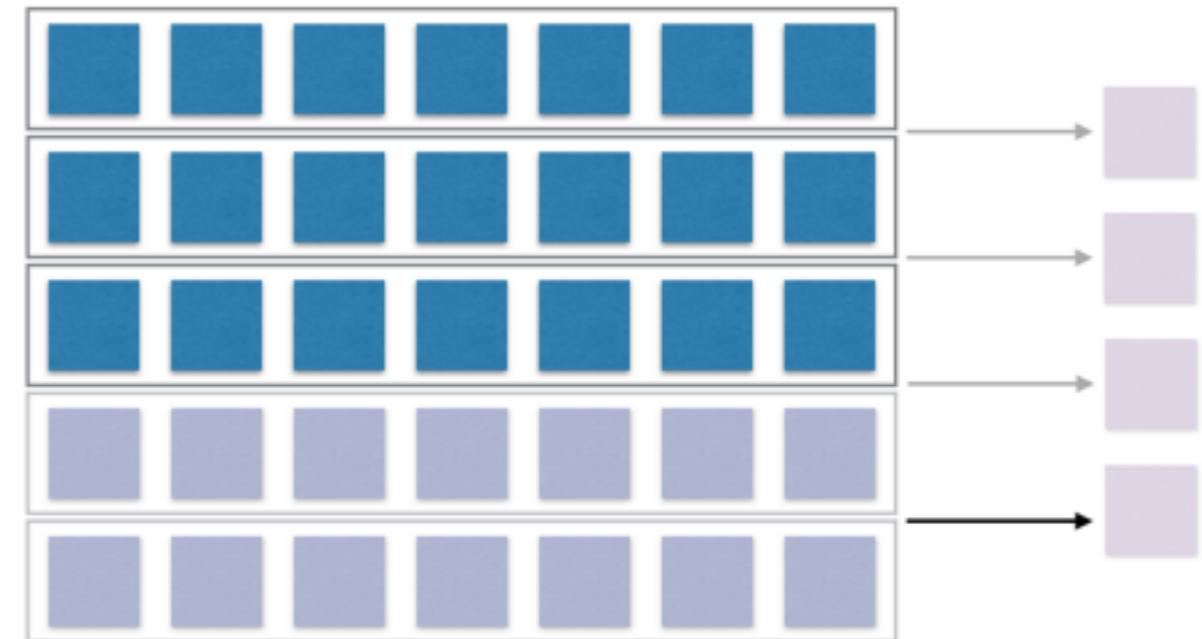
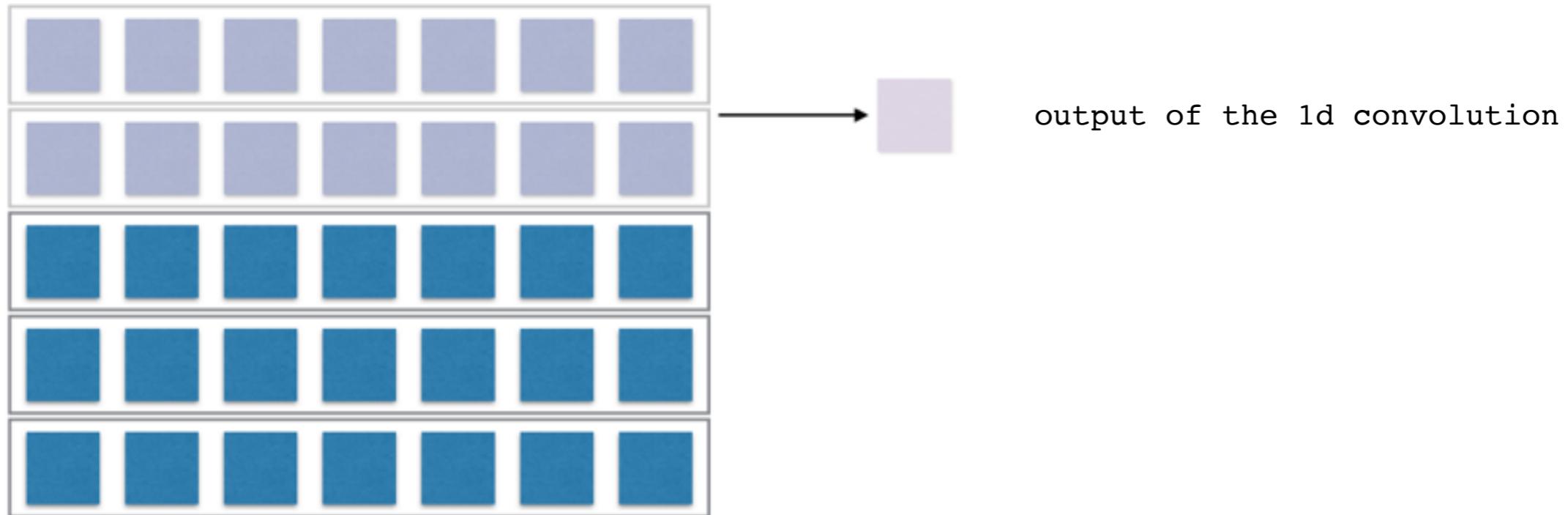
No knowledge of words

No previous knowledge is needed!

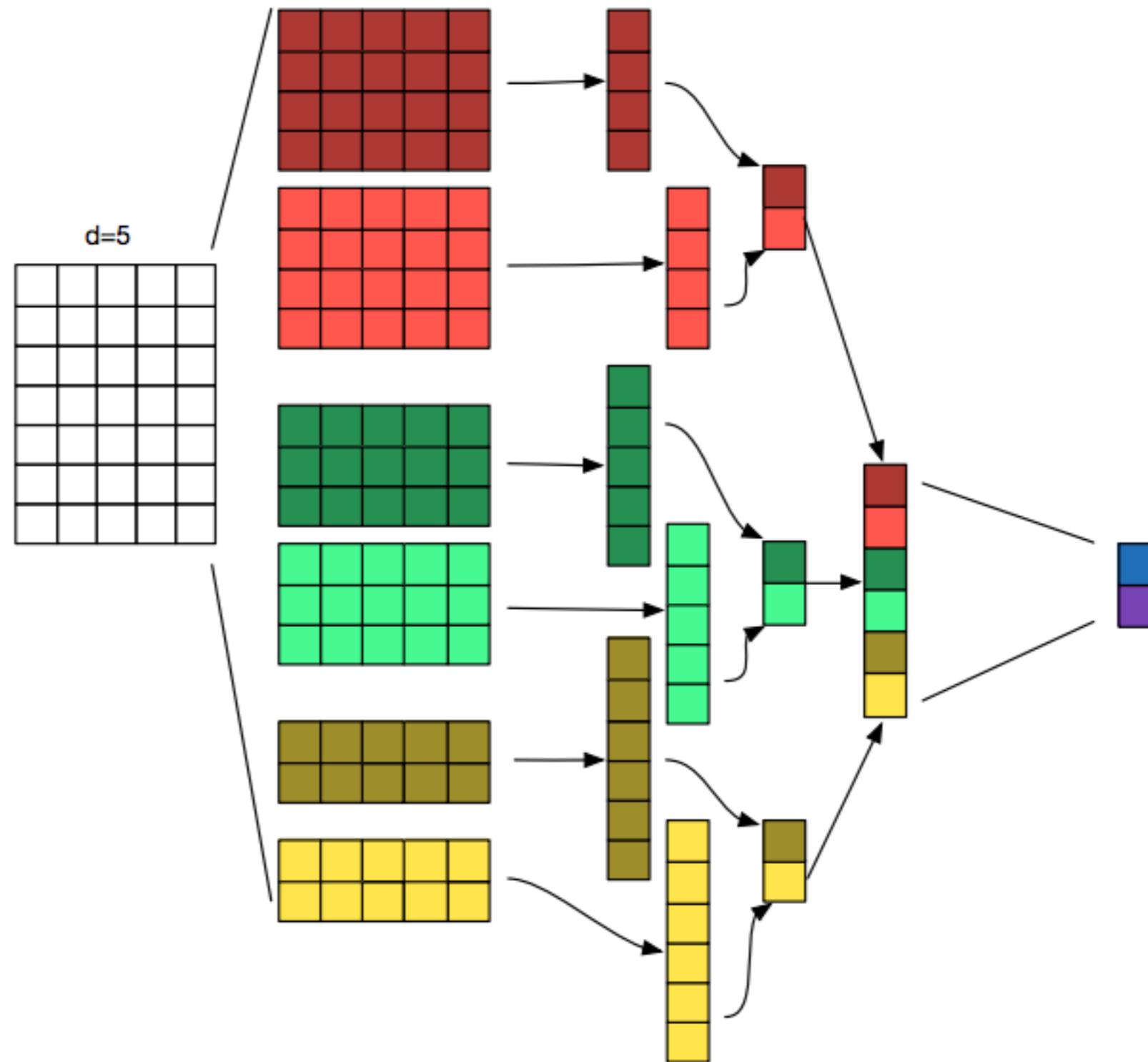
# How CNNs work with Text?



# How CNNs work with Text?



# How CNNs work with Text?



# Conclusion

Character-level VDCNNs are able with no previous knowledge to understand from scratch a given text. This architecture operates at the lowest atomic representation of text.

Despite convolutional layers are by construction local, deep CNNs are anyway able to learn high-level hierarchical representation of a text.



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