Introduction to Neural Networks for Natural Language Processing

Natural Language Processing in Neural Networks

Natural Language Processing in Neural Networks

- Recap: Neural Networks.
- Language as a Neural Network input.
- The nature of Natural Language.
- Notebook introduction: Representing text on Neural Nets!

Recap: Neural Networks

- The previous lesson introduced neural networks as **sequences of transformations** on an input vector to produce an output.

- To capture non-linear relationships, neural networks use **activation functions** and multiple **‘stacked’ weight transformations called layers**.

- Finally, they are trained automatically by using **optimizers** that try to minimise a **loss function** measuring how wrong the predicted output is.

Recap: Neural Networks

- Our introduction brushed over internal details and vocabulary and **focused on practical usage**.

- The intuition of a neural network is that of a function for which **we know inputs and desired outputs**, but whose **internal details are learned automatically**.

- However, all our inputs so far have focused on points on a bidimensional plane… **What about text?**

Language as a Neural Network input

- So far **we have focused on ‘continuous’ inputs**, such as points in a plane.

- Language is not quite like that: **text is made up of paragraphs, those of sentences, words, characters…**

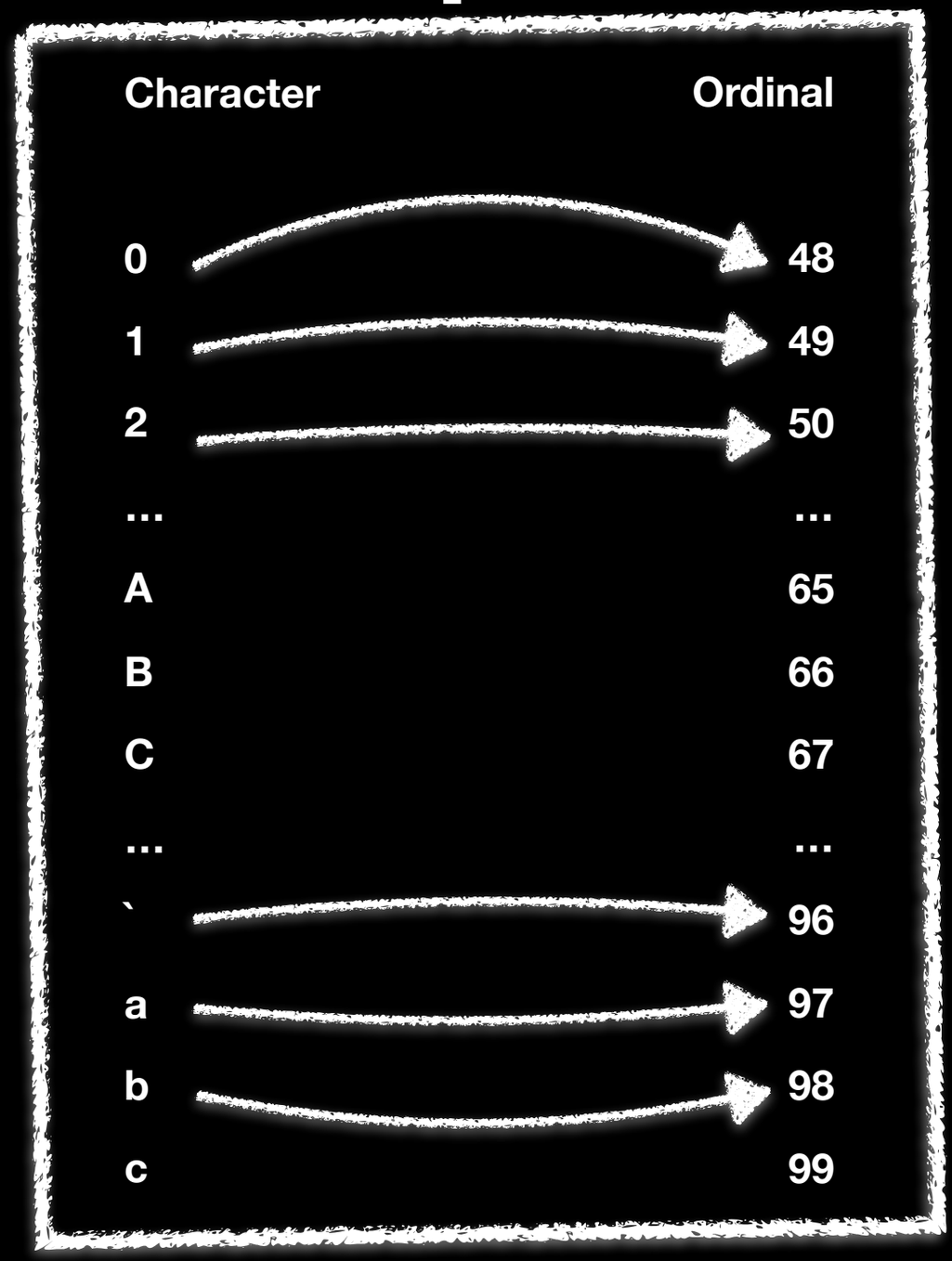
- Which level of detail should we use? What is more similar to a ‘point’?

Language as a Neural Network input

- A naïve idea: every character is represented by a given number, so **we can create a neural network whose input is just a large vector of numbers**!

- Every character becomes a number effortlessly by **using the ordinals as an input**.

- The network **must now distinguish between patterns among these ordinals**…

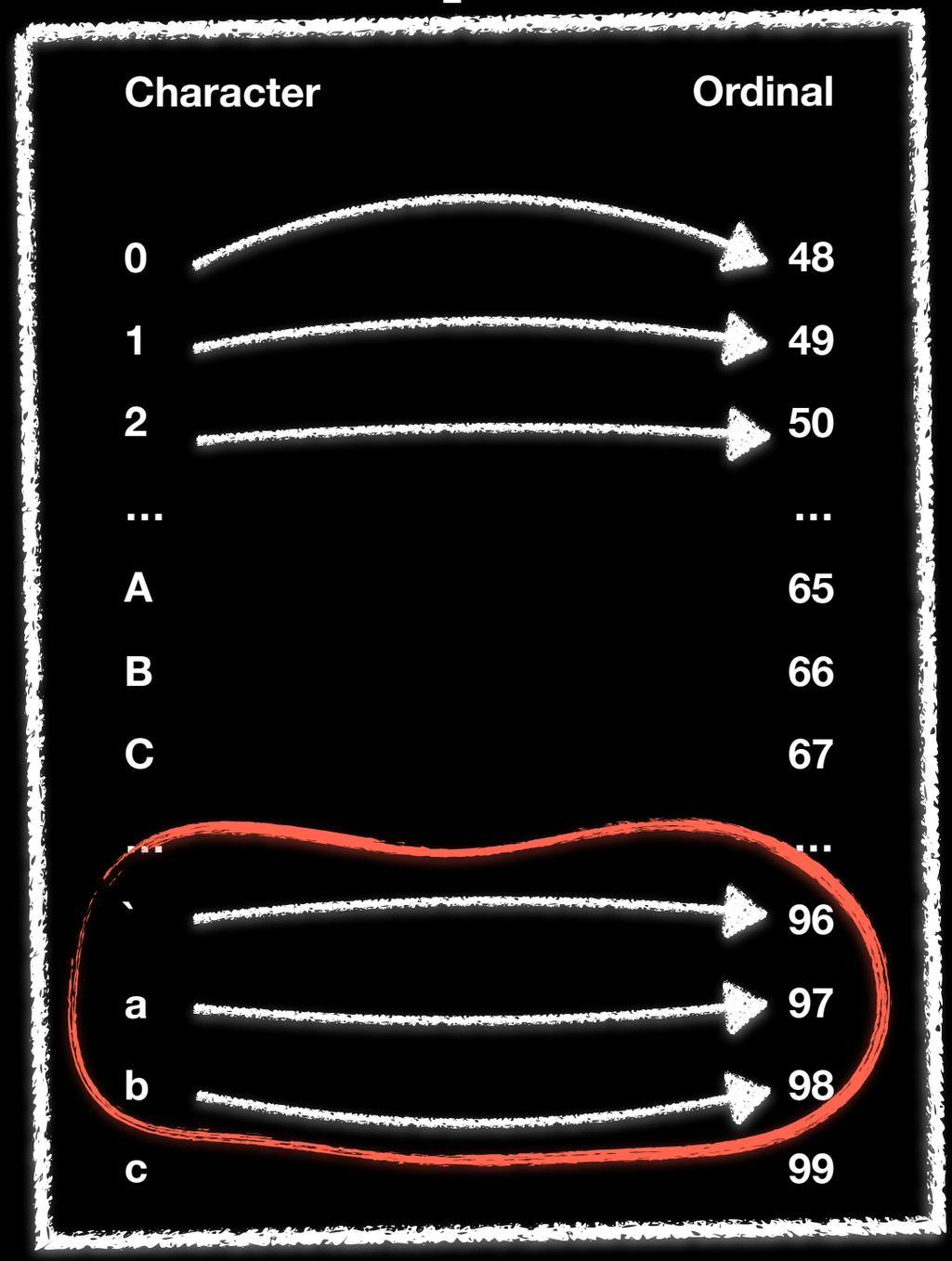


Language as a Neural Network input

- A naïve idea: every character is represented by a given number, so **we can create a neural network whose input is just a large vector of numbers**!

- The problem: **‘`’, ‘a’ and ‘b’ represented in an order, but the order is not meaningful**!

- How could a network **distinguish characters at each vector position**?



The nature of Natural Language

- Natural language is **sequential** and underlined by certain rules: **orthography, grammar and semantics**.

- A model capable of representing language **must include information at every level**…

- …but we mostly care about meaning, and **words are the units that carry some by themselves**!

The nature of Natural Language

- Using words and focusing on semantics still begs the question: **how are words fed into a neural network?**

- Any representation needs to deal with the **underlying logic and order of words**.

- The choice depends on the problem, as order might be more or less important depending on the context…

Notebook introduction: Representing text on Neural Nets!

- With this gentle picture of **the problems of dealing with text in neural networks**, it's time to dig in!

- The best way to understand the problems is to **explore some approaches for representing text, and evaluate them on real tasks**!

- This is exactly what we will do on the third notebook of the course: **figure out the different ways to feed text on a neural network and their pros and cons… Let's go!**

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