Introduction to Machine Learning

Lasse Hansen

lasse.hansen@clin.au.dk

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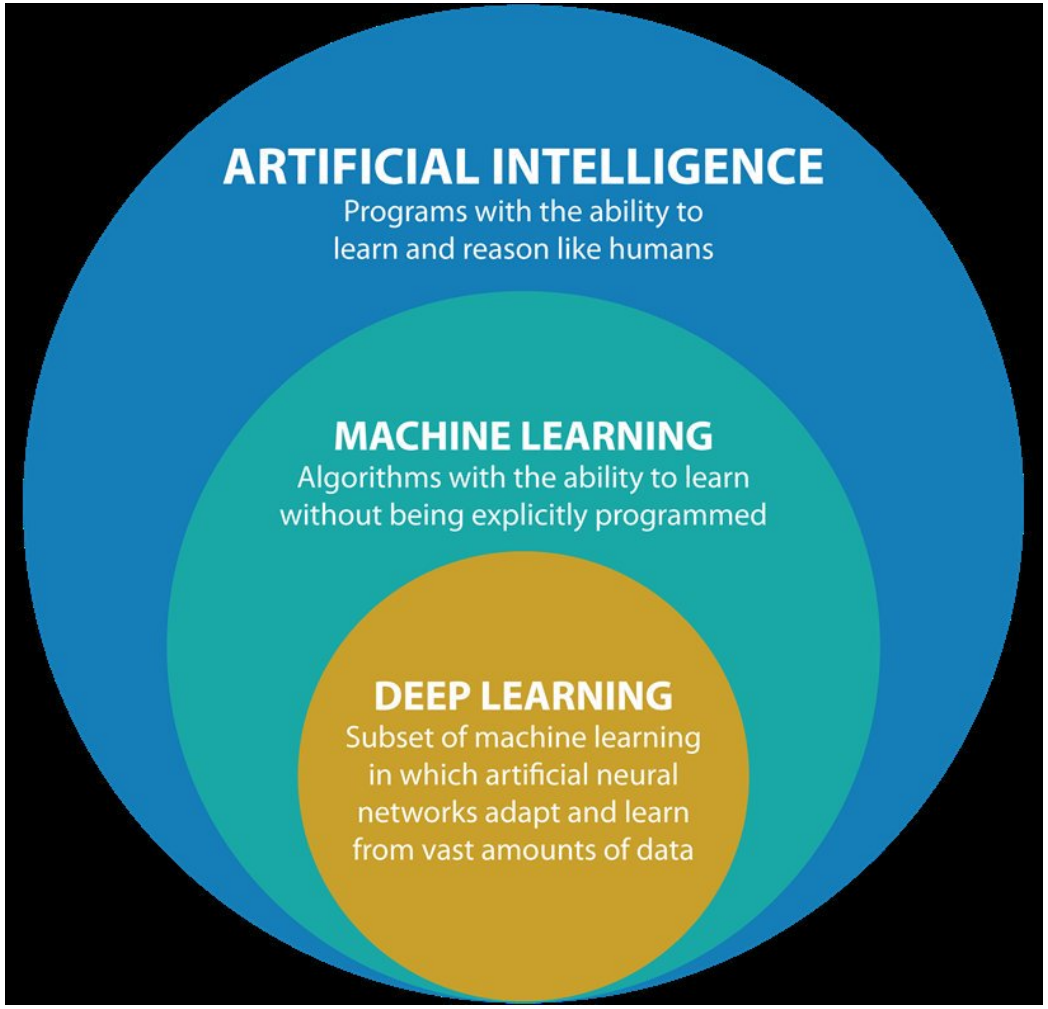
AARHUS UNIVERSITY

CENTER FOR HUMANITIES COMPUTING AARHUS

Terminology


ARTIFICIAL INTELLIGENCE
Programs with the ability to
learn and reason like humans
MACHINE LEARNING
Algorithms with the ability to learn
without being explicitly programmed
DEEP LEARNING
Subset of machine learning
in which artificial neural
networks adapt and learn
from vast amounts of data

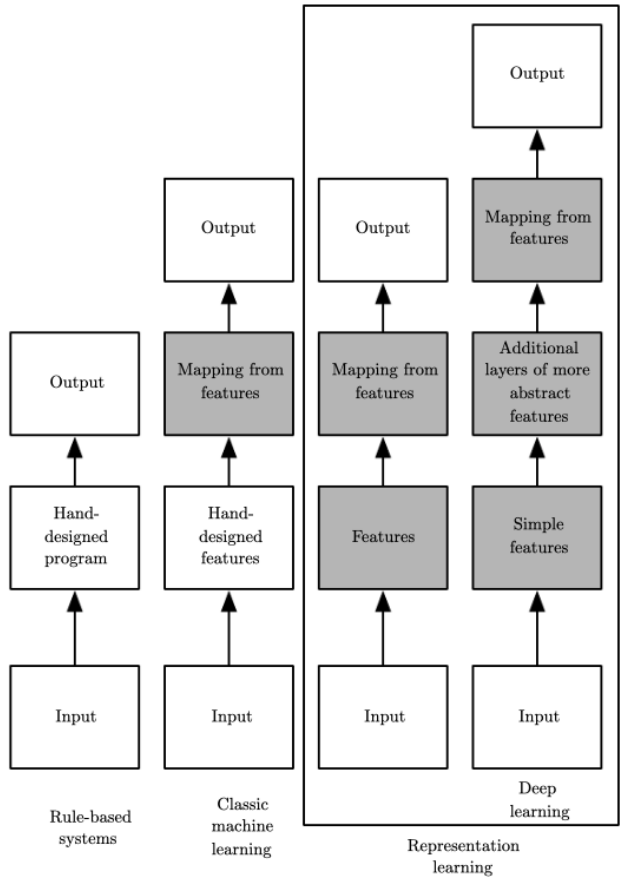
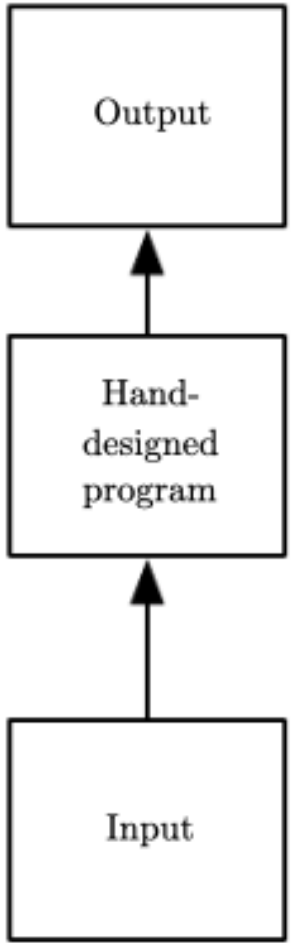


Figure 1.5: Flowcharts showing how the different parts of an AI system relate to each other within different AI disciplines. Shaded boxes indicate components that are able to learn from data.

Rule-based Models

Rule-based Models



Flowcharts and decision trees based on *expert knowledge* or *learned from data*.

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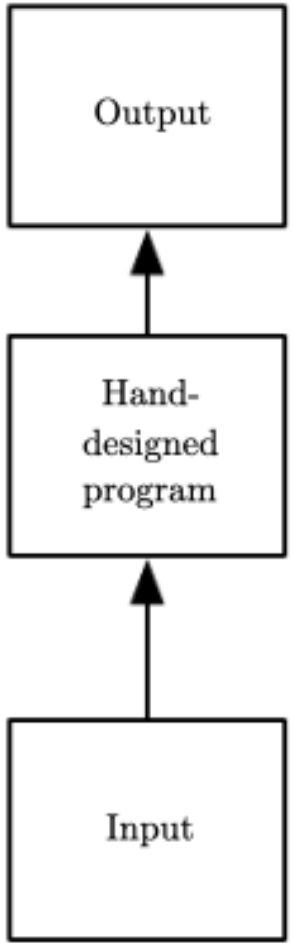

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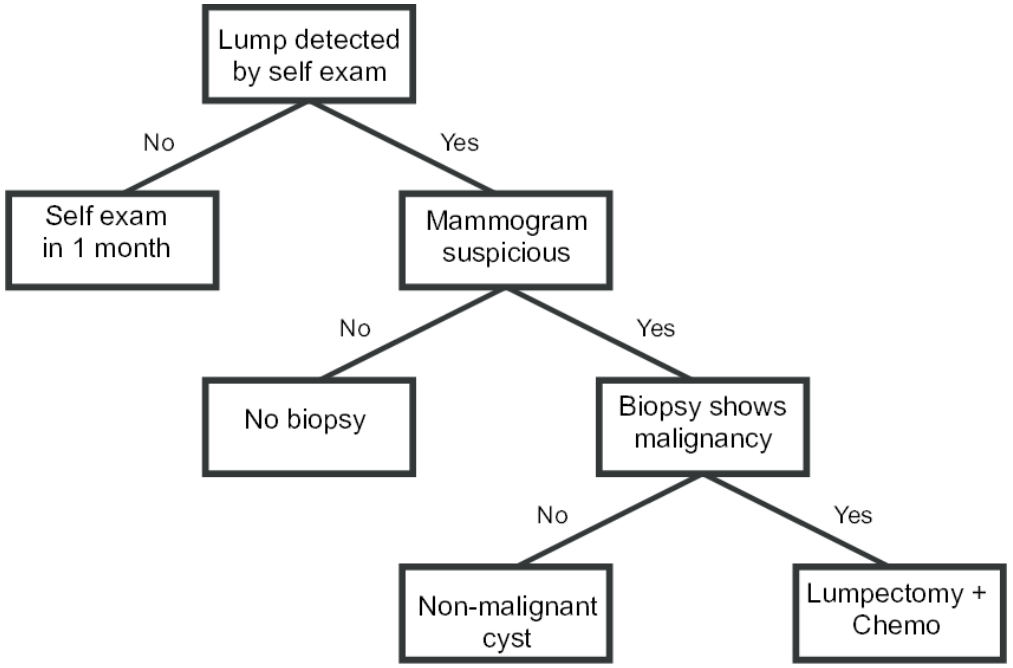
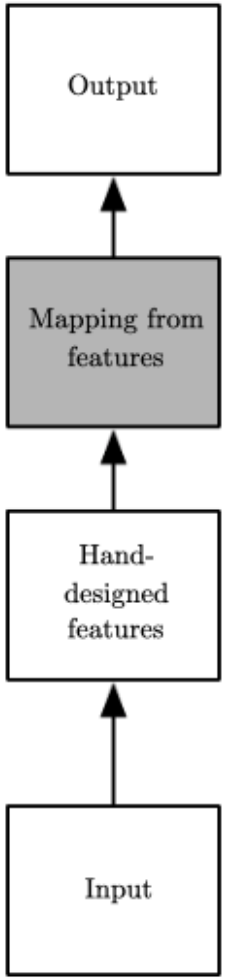


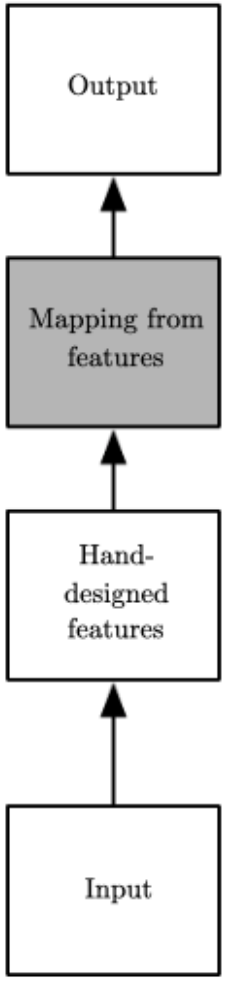
Classical Machine Learning

Classical Machine Learning



Models that learn from *structured features* such as what you find in the *SFIs* in the EHRs.

Classical Machine Learning



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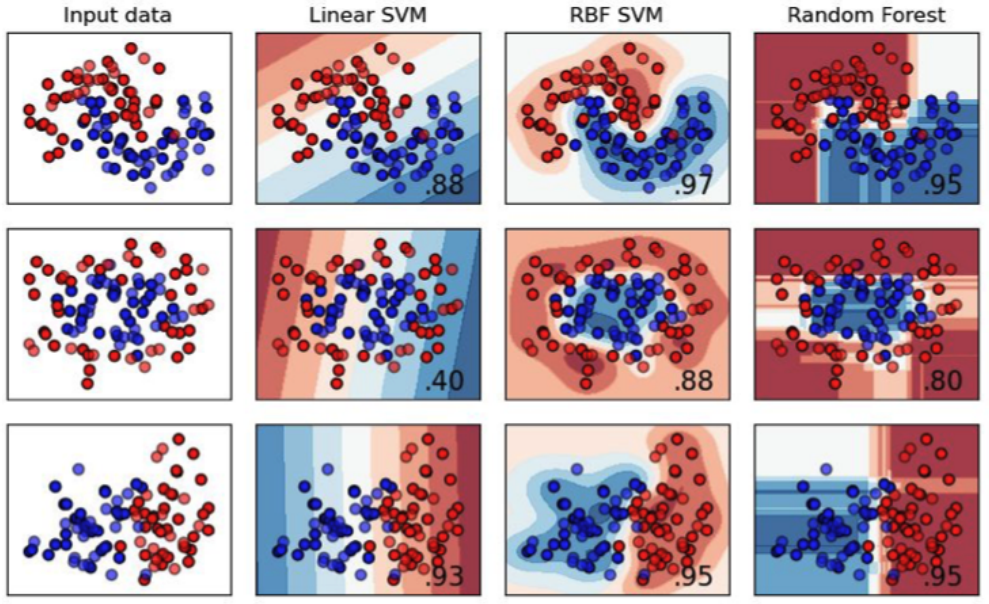
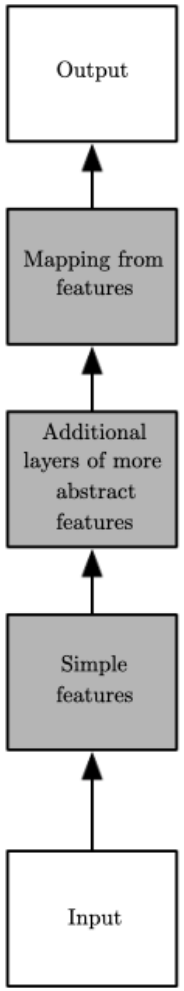


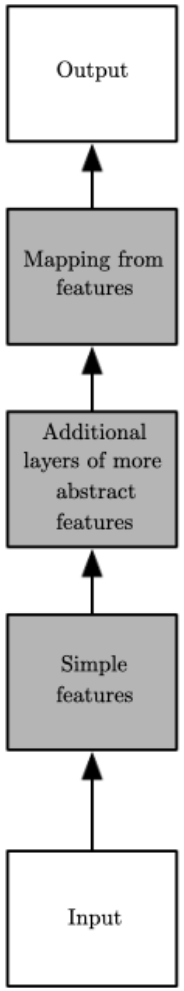
Representation/Deep Learning

Representation Learning



Models *create their own representation* from raw input data

Representation Learning



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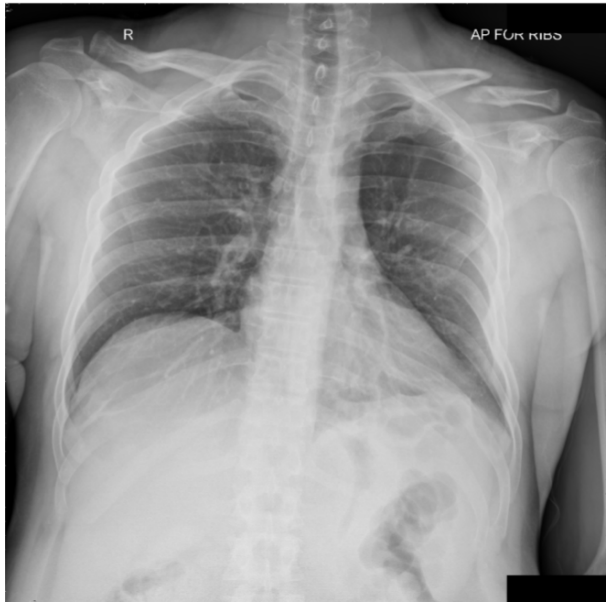

Neural Network Foundations

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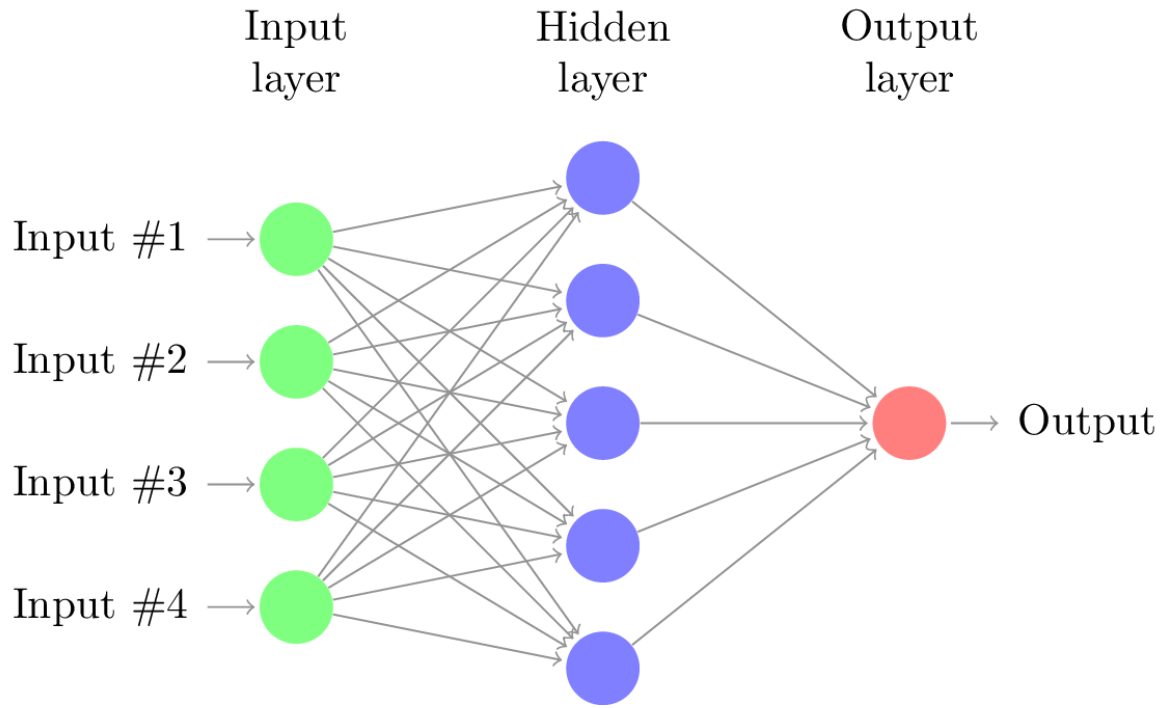
Multiple layers of *non-linear* processing



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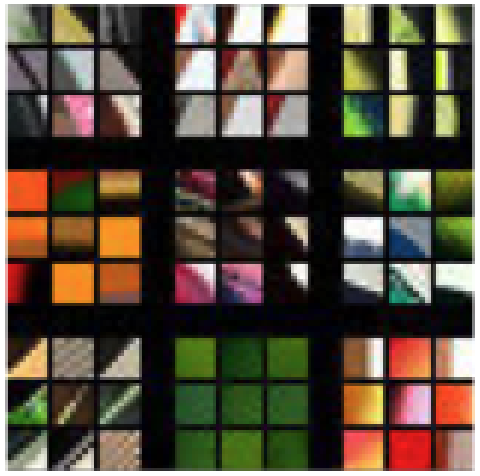

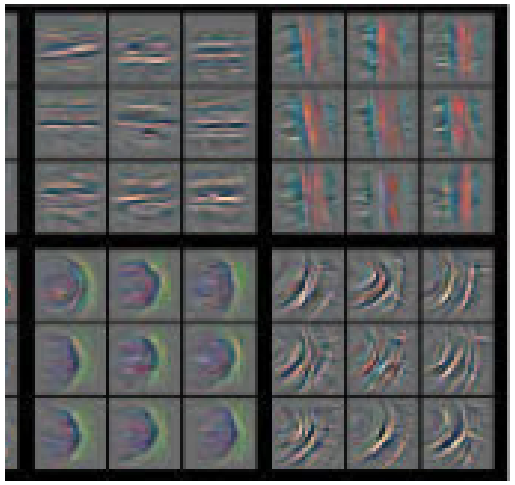

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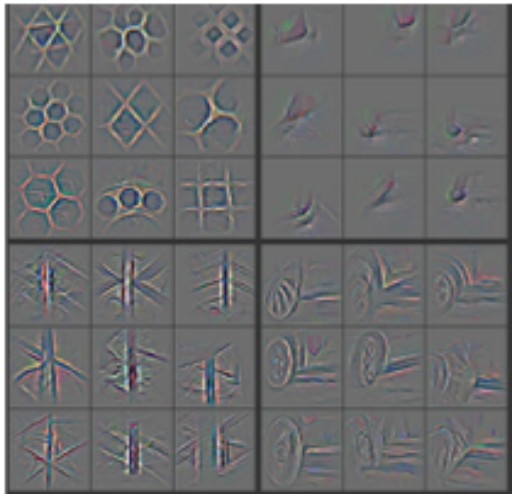

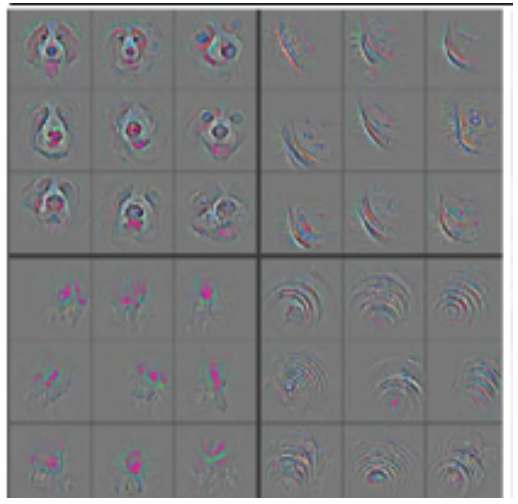

Natural Language Processing

Natural Language Processing

Computers don't like working text. We need to convert it to numbers somehow.

Solution? Word vectors.

Handcrafted Word vectors

> it was the best of times
>
> it was the worst of times
>
> it was the age of wisdom
>
> it was the age of foolishness

best	the	times	was	worst	age	wisdom	foolishness
1	1	1	1	0	0	0	0
0	1	1	1	1	0	0	0
0	1	0	1	0	1	1	0
0	1	0	1	0	1	0	1

Handcrafted Word vectors

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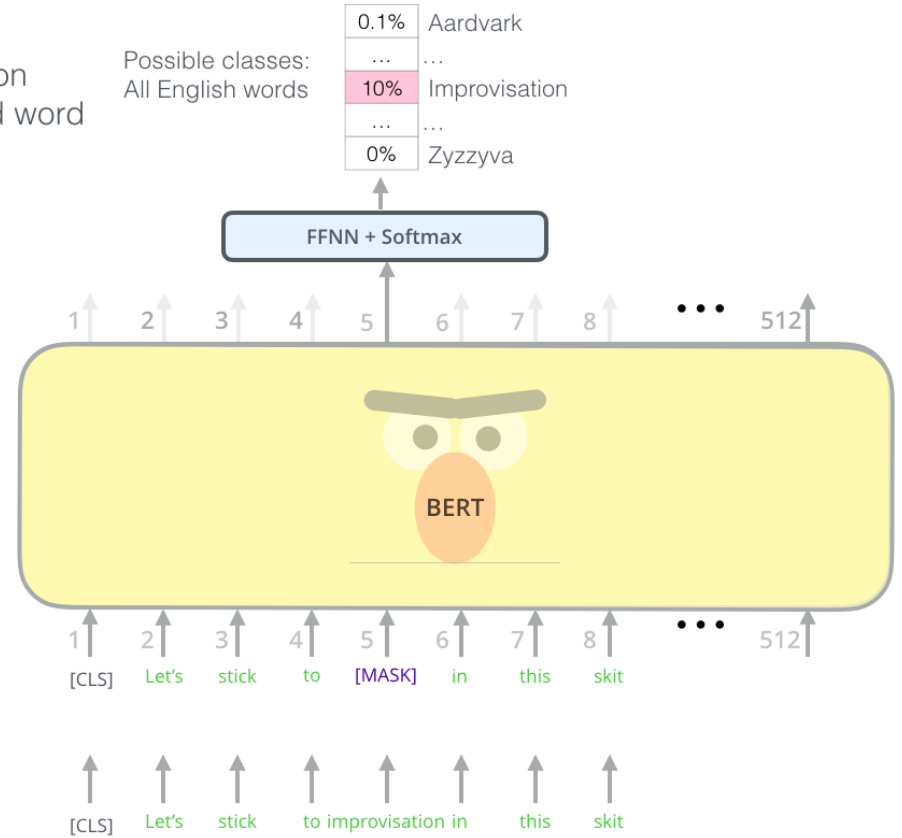
Context and semantics are completely disregarded!

Instead, train a deep learning model to learn *contextualized word vectors*

BERT

Use the output of the masked word's position to predict the masked word



Randomly mask 15% of tokens

Input

Take Home Messages

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Machine Learning

- Learning from *handcrafted features*
- Encompasses a wide range of models, and very useful for most tasks
- Does not handle complex tasks like image or text analysis very well

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NLP

- How to turn text into meaningful representations for computers
- BERT learns *contextualised word representations*
- *Transfer learning* is key to the success of deep learning and NLP

Questions?