

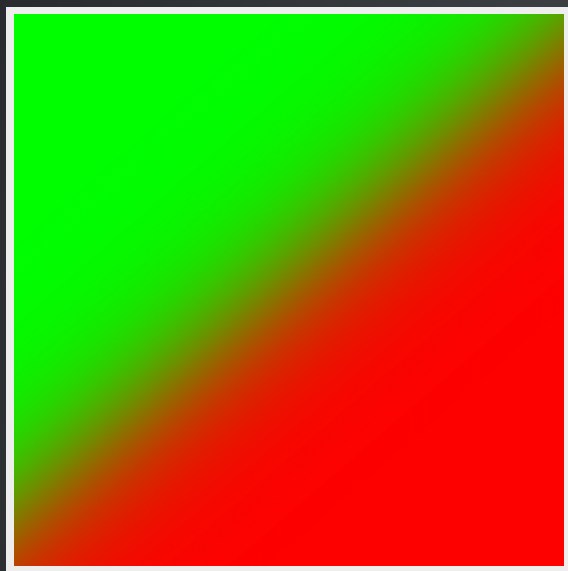
MACHINE LEARNING IN HIGH ENERGY PHYSICS

PRACTICAL CLASS #5

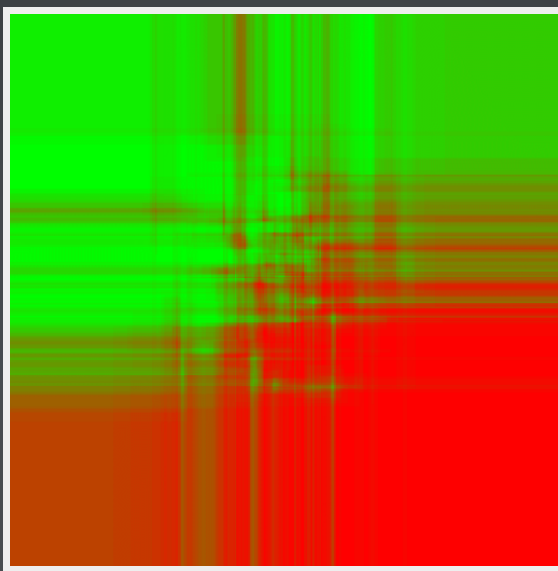


Alex Rogozhnikov, 2015

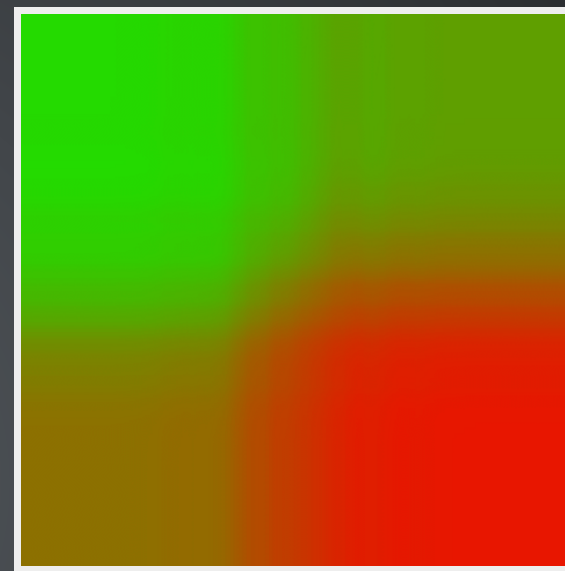
RECAP: RANDOM FORESTS



Optimal boundary

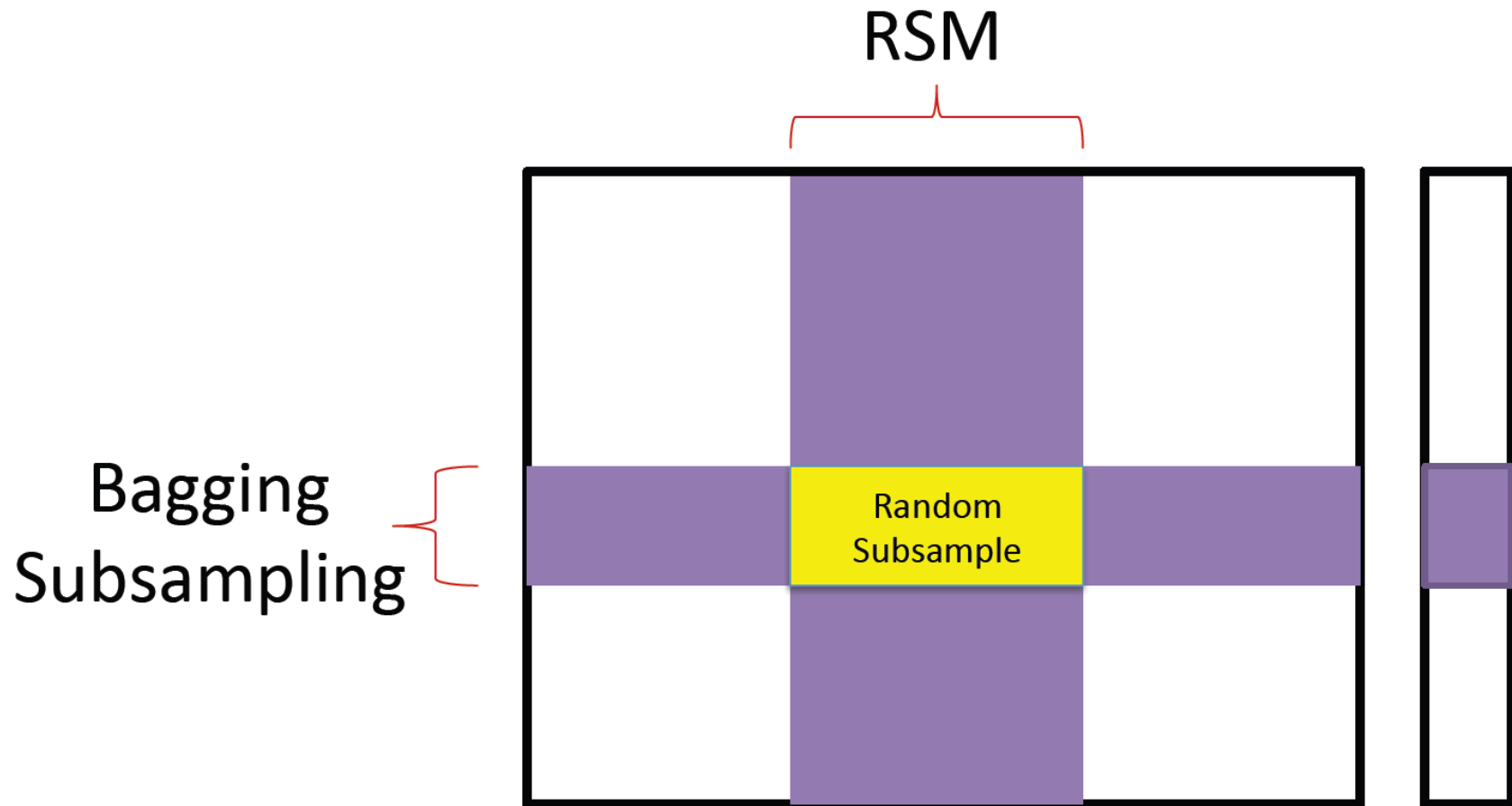


50 trees



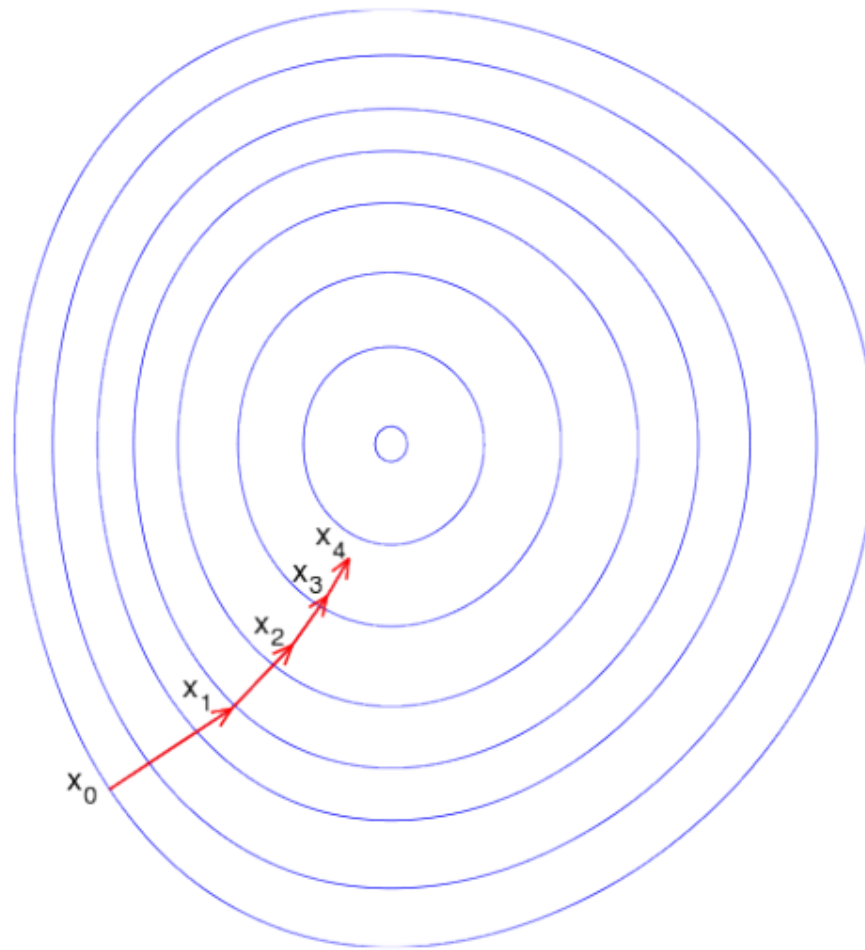
2000 trees

RECAP: RANDOM FORESTS

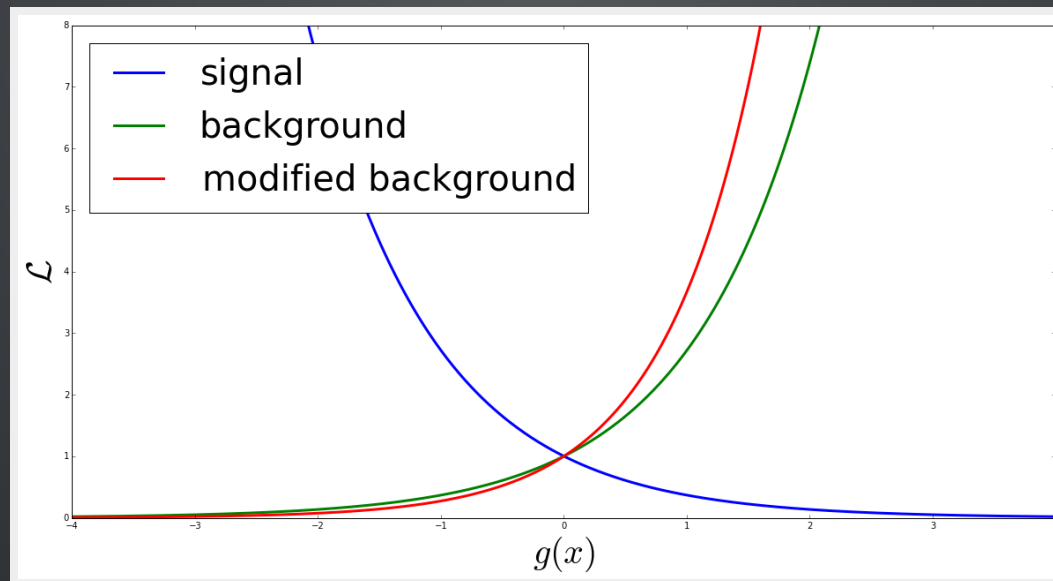
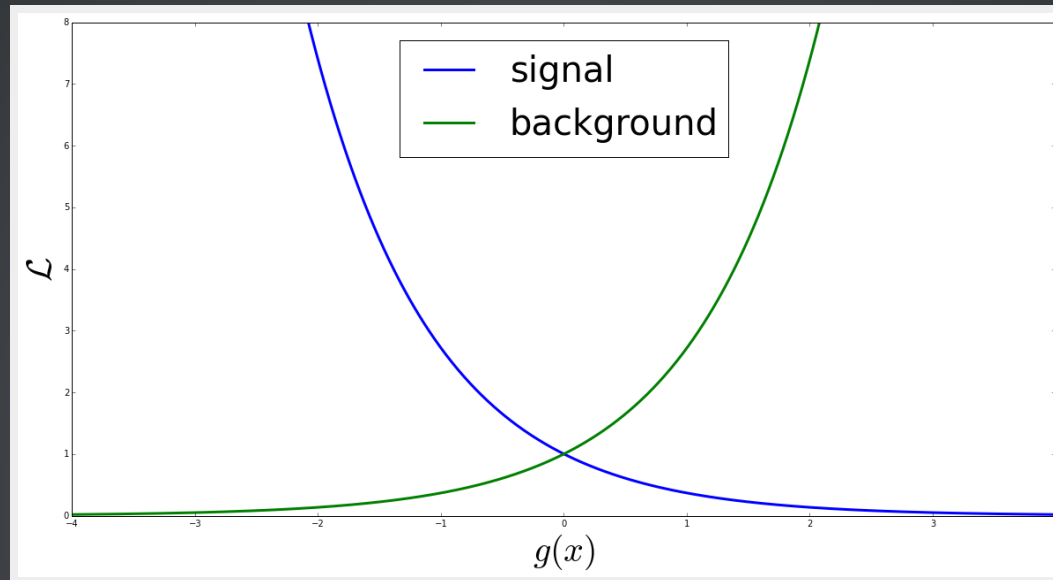


RECAP: GRADIENT DESCENT

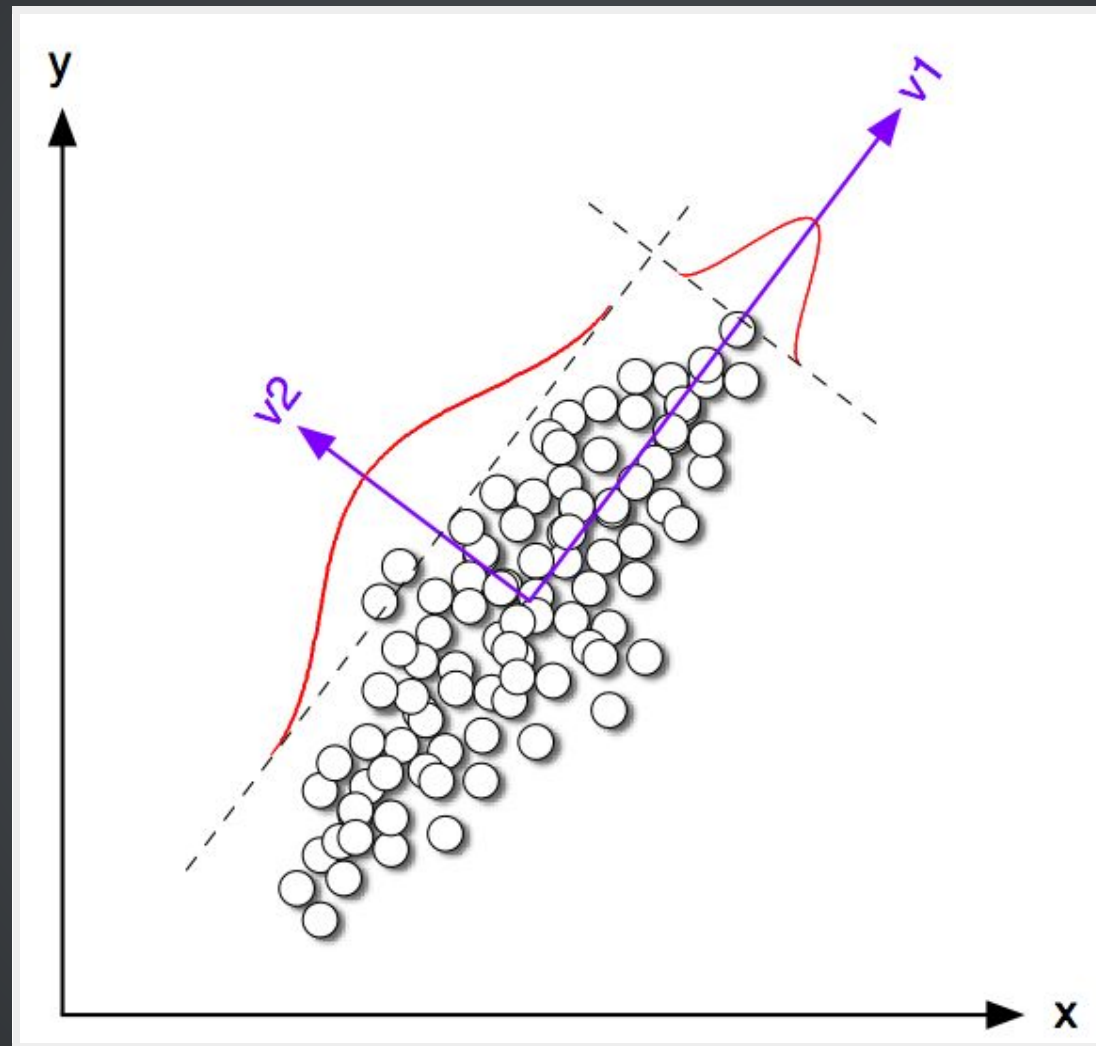
$$\tilde{x}^m = \tilde{x}^{m-1} - \lambda \nabla f(\tilde{x}^{m-1})$$



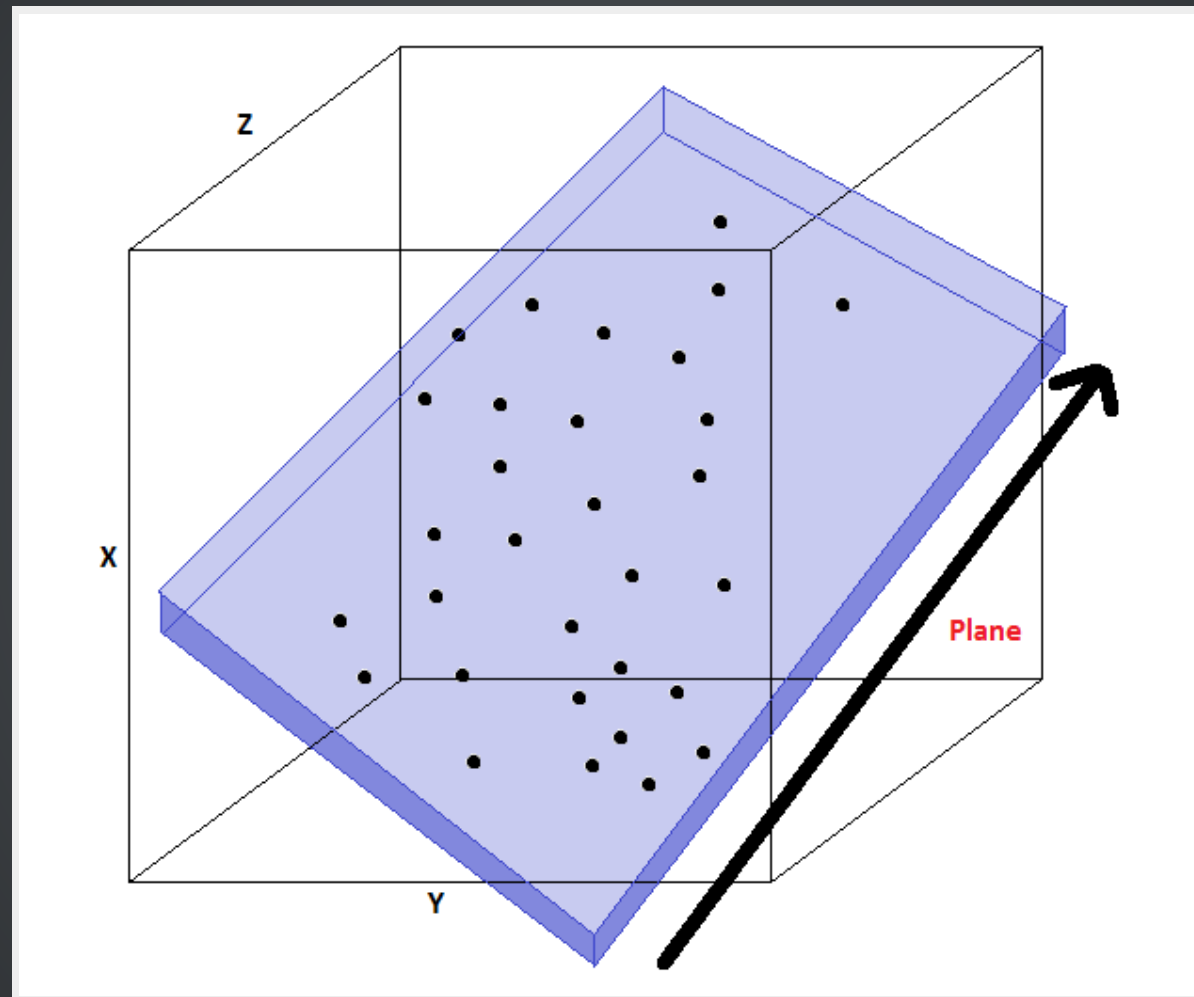
RECAP: LOSSES



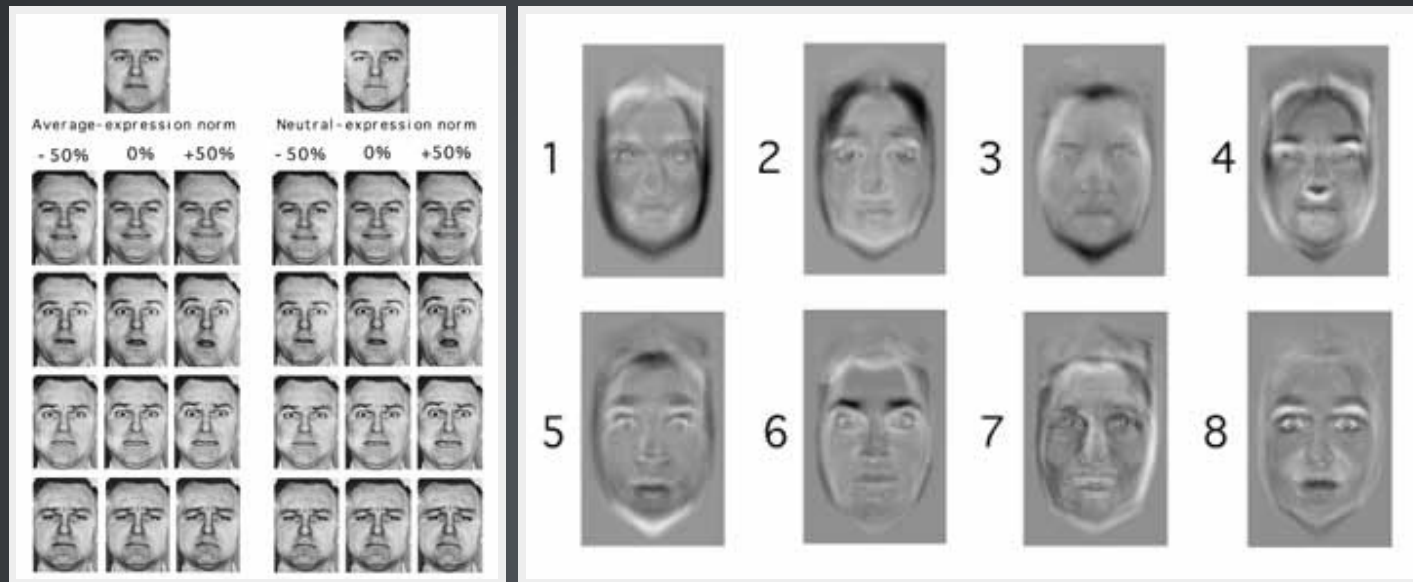
PCA



PCA

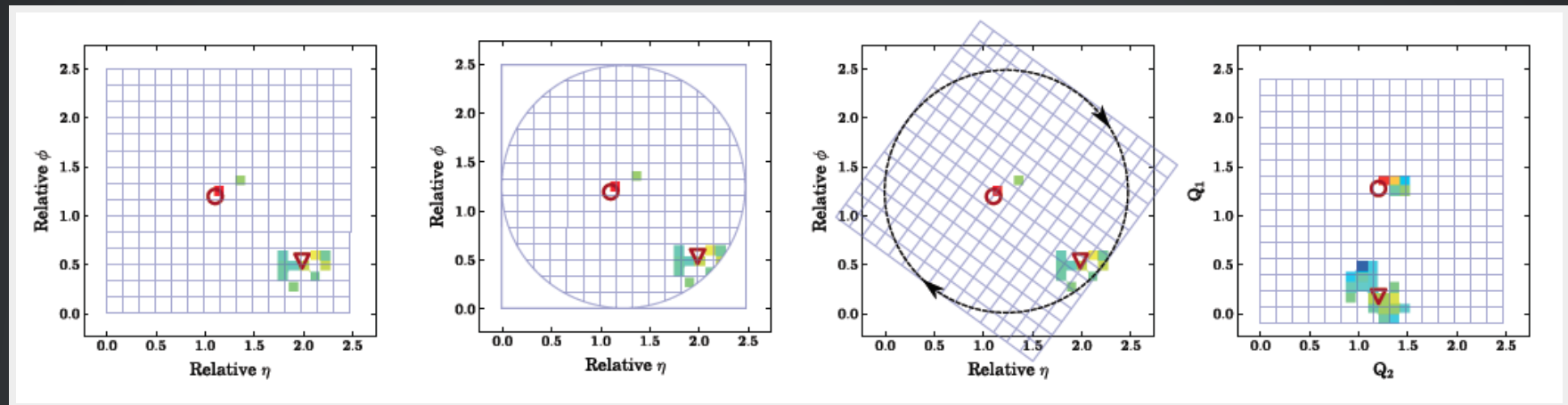


PCA: EIGENFACES



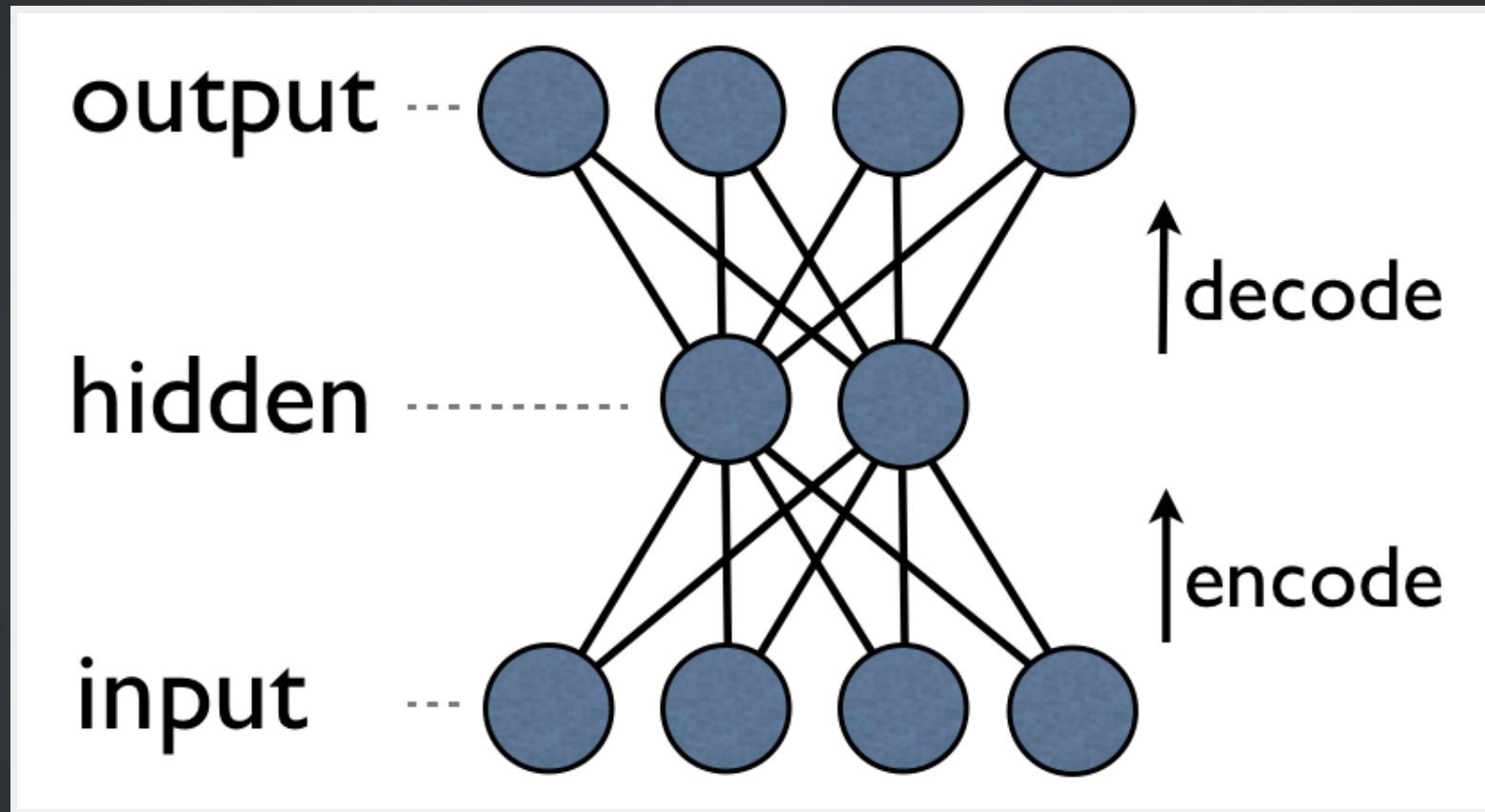
$$\text{Emotion} = \alpha[\text{scared}] + \beta[\text{laughs}] + \gamma[\text{angry}] + \dots$$

PCA: CALORIMETER

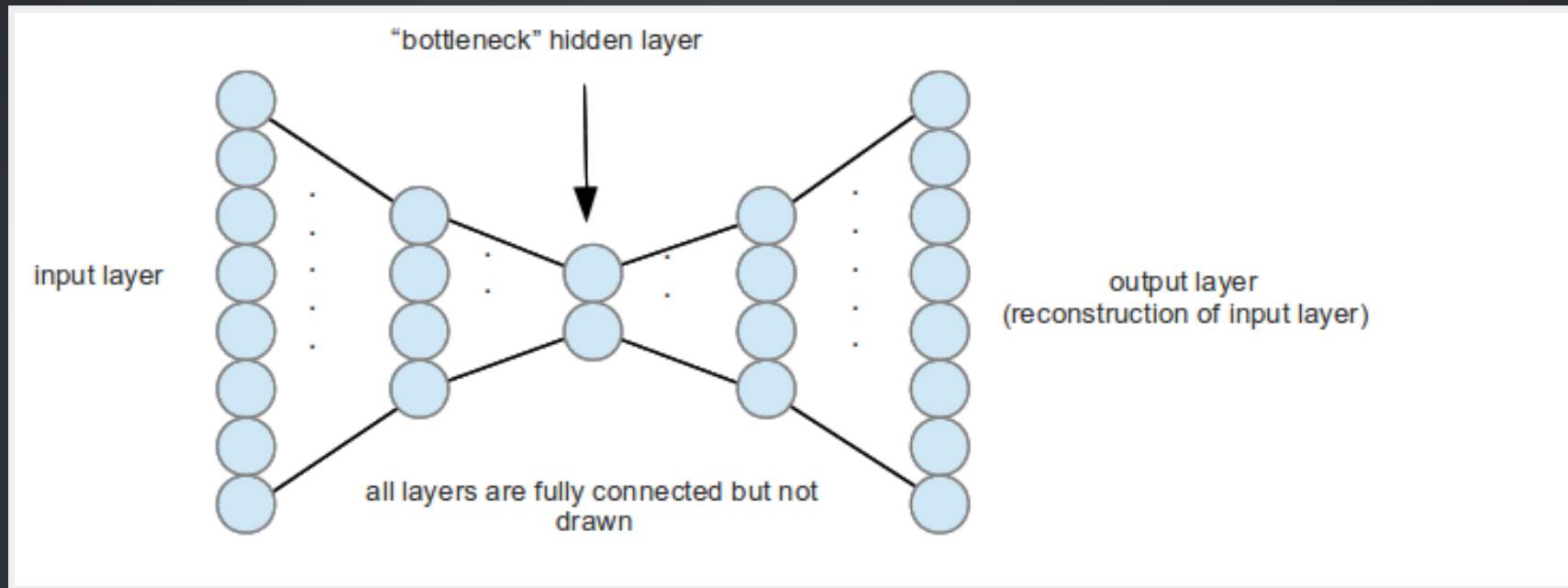


Electron/jet recognition in ATLAS

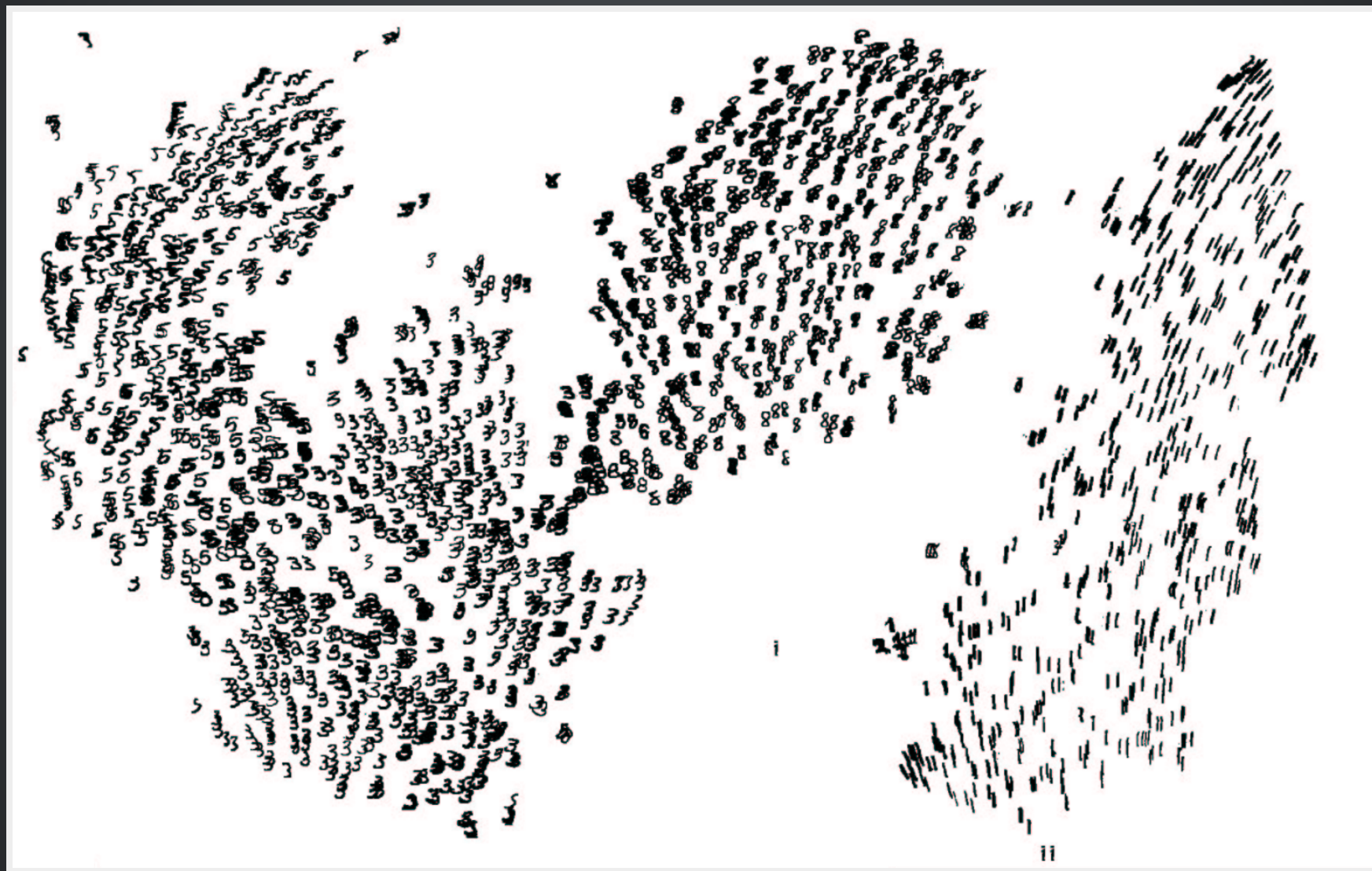
AUTOENCODER



DEEP AUTOENCODER



DIMENSIONALITY REDUCTION



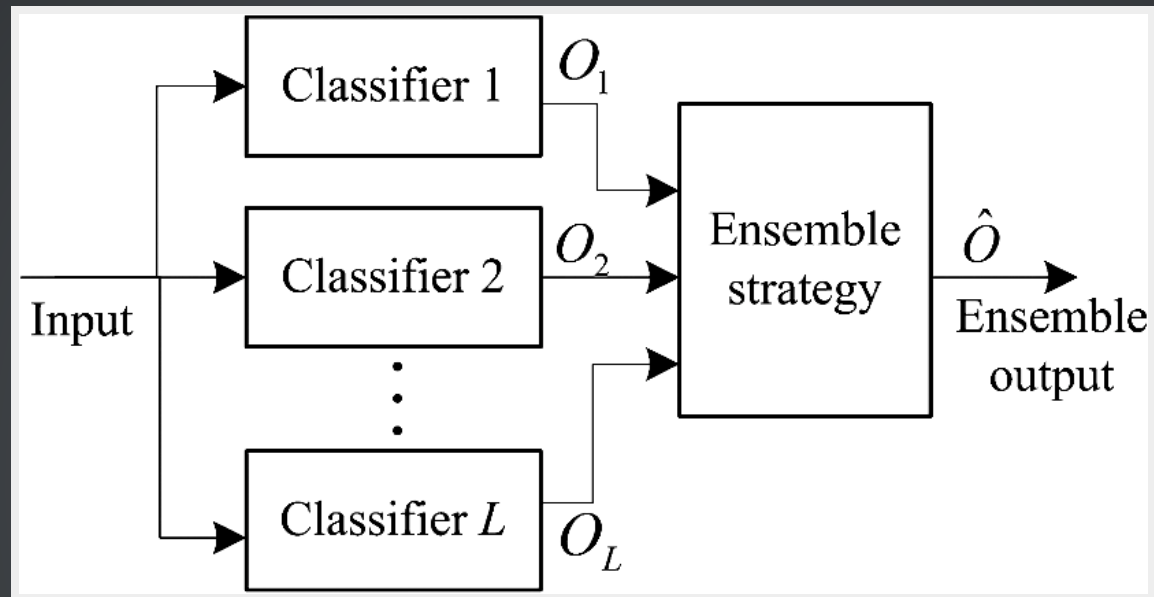
REAL DATA VS MC

From the MINST Database of Hand-written Digits



2 8 7 4 3 8

STACKING OF CLASSIFIERS



- training on subchannels
- Jet/lepton tagging, particle identifications are particular cases.
- Reconstruction of prompting features

REPRODUCIBILITY

REPRODUCIBILITY OF EXPERIMENT

Numerical experiment is an experiment too

- OS
- libraries
- code
- data
- results (including intermediate ones)

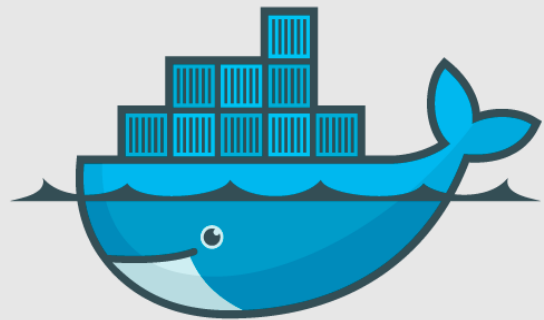
ANALYSIS PRESERVATION?

WHY USING VIRTUAL MACHINE

- Software evolves, interfaces are changed
- Terribly complicated system with many dependencies
- High probability that code won't work after several years

Provide virtual machine with your environment

DOCKER (VM-LIKE SOLUTION)



docker

- Lightweight (no OS)
- Versioning
(incremental updates)
- Combining containers

CODE & RESULTS TOGETHER: IPYTHON

GITHUB + NBVIEWER

last version
some fixed version

DATA PING-PONG

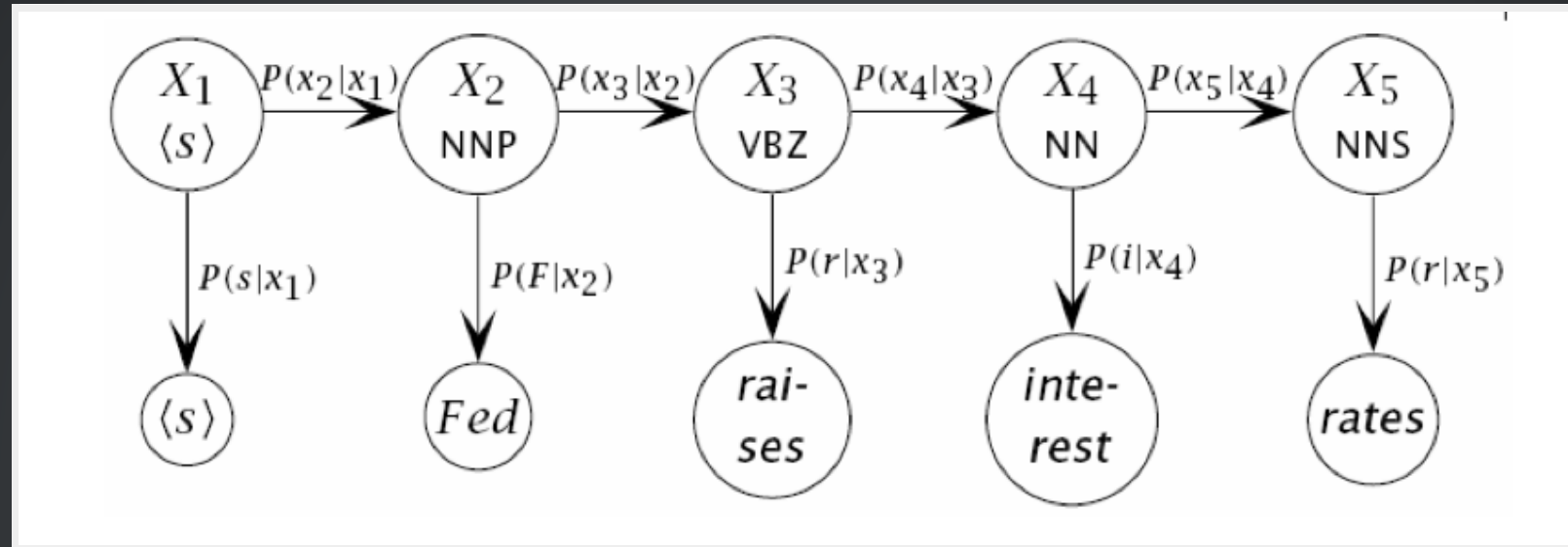
- It's a bad idea when you perform different stages on different PC's
- Use remote server
- Everything becomes notably faster when one command reruns all the process
- In IPython, shell commands are prefixed with !

```
!ping www.bbc.co.uk
```

POS TAGGING

- “**Plants**/**N** need light and water.”
- “Each one **plant**/**V** one.”
- “Flies like a flower”
 - *Flies*: noun or verb?
 - *like*: preposition, adverb, conjunction, noun, or verb?
 - *a*: article, noun, or preposition?
 - *flower*: noun or verb?

POS TAGGING AND HIDDEN MARKOV CHAINS





THE END