Big data science
Day 1 - Hands on

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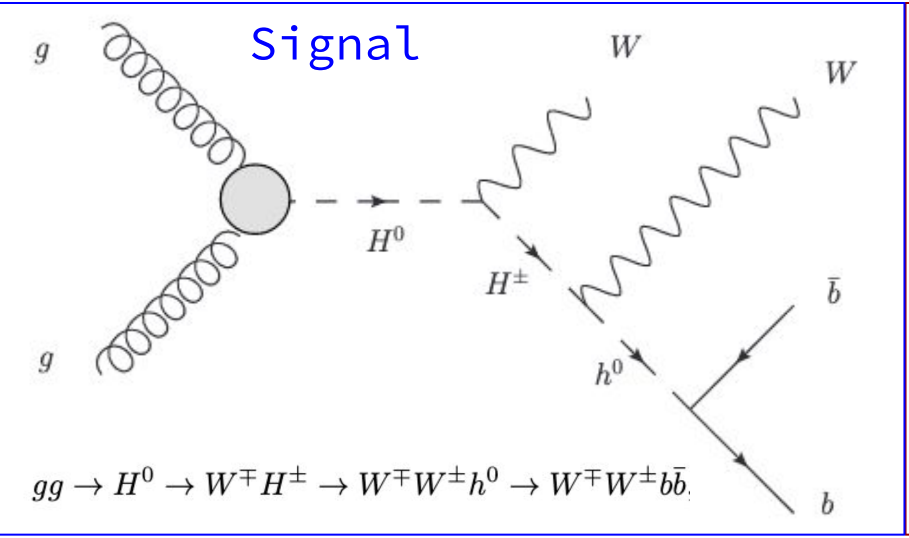
What we will use

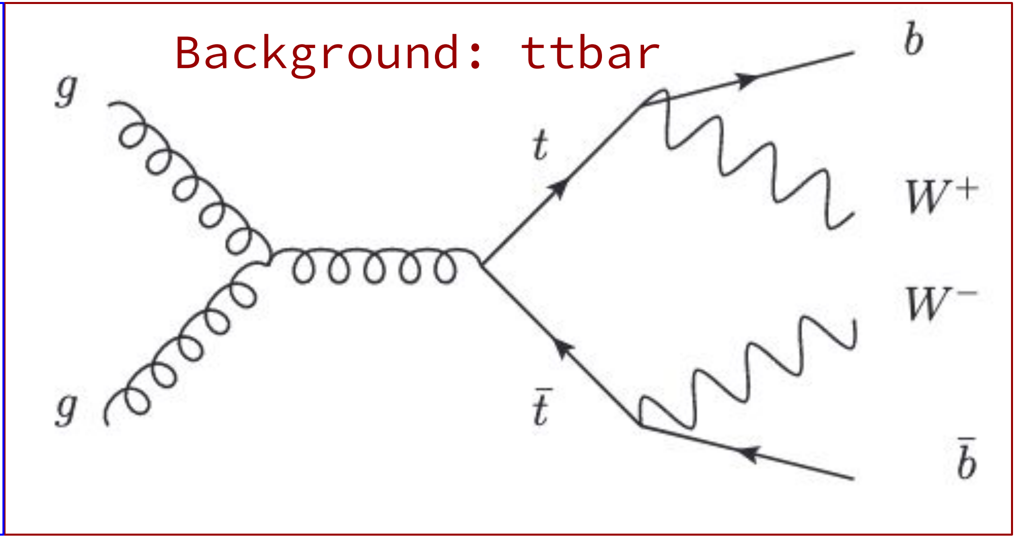
- **Python** with Jupyter notebooks
- Prerequisites: some familiarity with numpy and pandas
    - **Day 1:** familiarise with ML dataset, **parquet** files
- ML libraries
    - **Day 2: MLlib**
        - Gradient Boosting Trees **GBT**
        - Multilayer Perceptron Classifier **MCP**
    - **Day 3: Keras**
        - Sequential model
    - **Day 4: bigDL**
        - Sequential model

Input dataset for hands-on

- Open HEP dataset @UCI https://archive.ics.uci.edu/ml/datasets/HIGGS
- Signal (heavy Higgs) + background (ttbar)


Signal

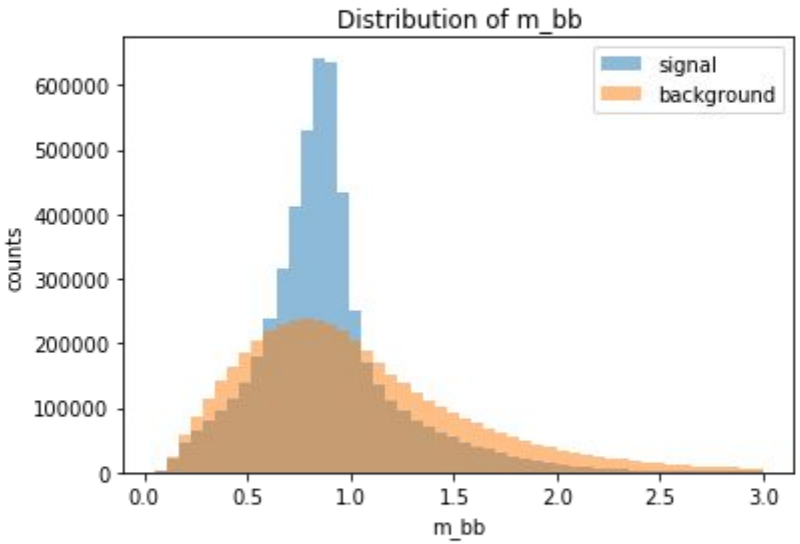
g
g
H^0
$H^\pm$
h^0
W
W
$\bar{b}$
b
$gg \to H^0 \to W^\mp H^\pm \to W^\mp W^\pm h^0 \to W^\mp W^\pm b\bar{b}$,


Background: ttbar

Baldi, Sadowski, and Whiteson. “Searching for Exotic Particles in High-energy Physics with Deep Learning.” Nature Communications 5

Input dataset

- Open HEP dataset @UCI, 7GB (.csv)
- 10M Monte Carlo events
  - 21 low level features
    - pt’s, angles, MET, b-tag, …
  - 7 high level features
    - Invariant masses (m(jj), m(jjj), …)
- Smaller datasets for code testing (1M, 100k)
- You’ll find them on HDFS

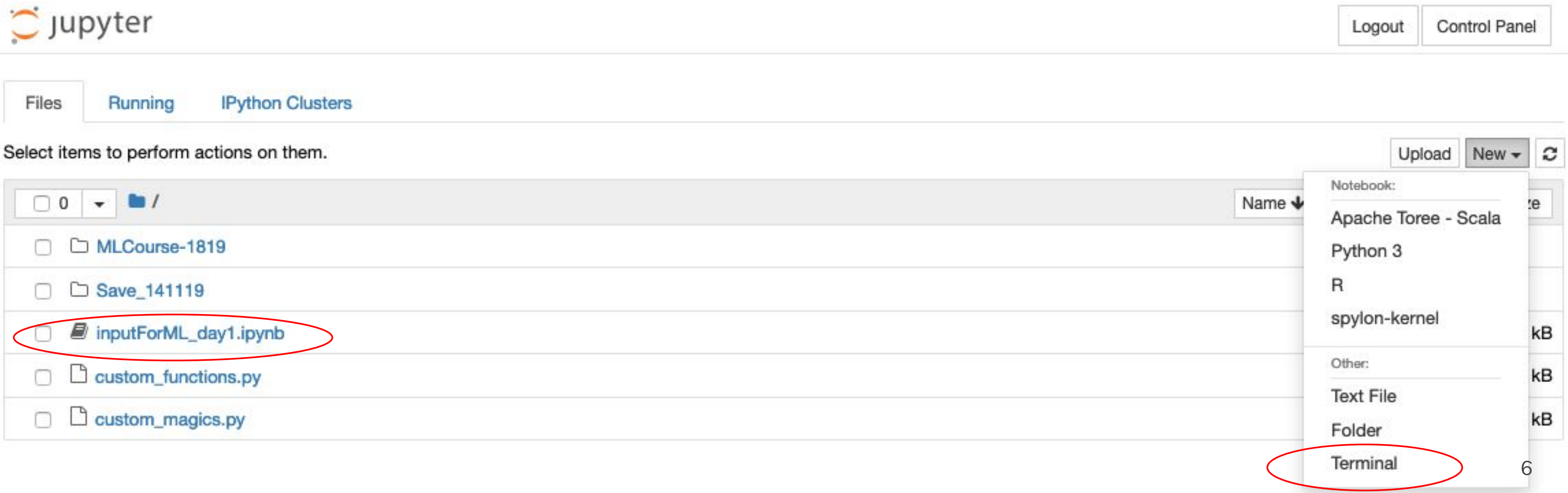


Hands-on today

- You will familiarize with *jupyter notebooks, numpy and pandas*
- Input data:
    - efficient format: convert **CSV to Parquet**
        - A comma-separated values (CSV) *file* is a delimited text *file* that uses a comma to separate values
        - And Apache parquet?
    - Create input for ML. Format depends on chosen ML library, in our case MLLib from Apache
- Visualization
    - *explore dataset, plot features*
    - *correlation matrix*
- ***Slides and notebooks available on github*** https://github.com/leggerf/MLCourse-1819

How to start

1. **Point your browser to:** https://yoga.to.infn.it
2. **Authenticate** through github
3. **Open a terminal:**
   - git clone https://github.com/leggerf/MLCourse-1819.git
   - cp MLCourse-1819/Notebooks/Day1/* .
4. **From JupyterHub Home tab:**
   - start and run *inputForML_day1.ipynb*


jupyter
Logout
Control Panel
Files
Running
IPython Clusters
Select items to perform actions on them.
Upload
New
0
/
Name
MLCourse-1819
Save_141119
inputForML_day1.ipynb
custom_functions.py
custom_magics.py
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Notebook:
Apache Toree - Scala
Python 3
R
spylon-kernel
Other:
Text File
Folder
Terminal