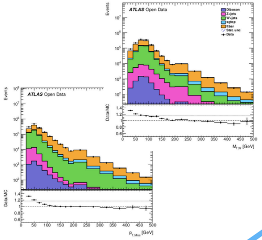
Deep Learning for ATLAS and Beyond

Deep Learning Classification @ LHC

Object definition → **13 TeV ATLAS Open Data**

Event selection → ROOT analysis →



Physical information of the events → **Visual recognition** Conversion into images → **Event classification**

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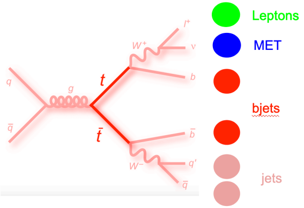
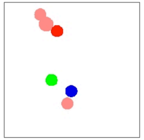
- Each **circle** represents a reconstructed **physics object**.
- Each **color** corresponds to a different **type of object**.
- Four momentum of the particles encoded in images.

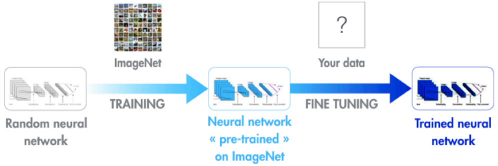


This image represents a collision

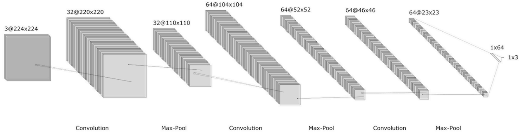


Transfer learning

- VGG16 (benchmark)
- VGG19
- ResNet50



Non pre-trained CNN



- Trained from scratch
- 13 layers (less parameters)

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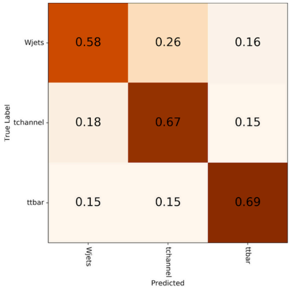
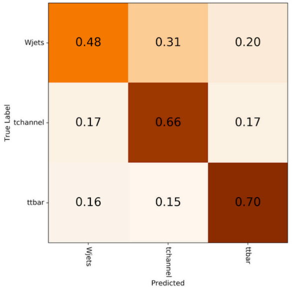
CNN VGG16



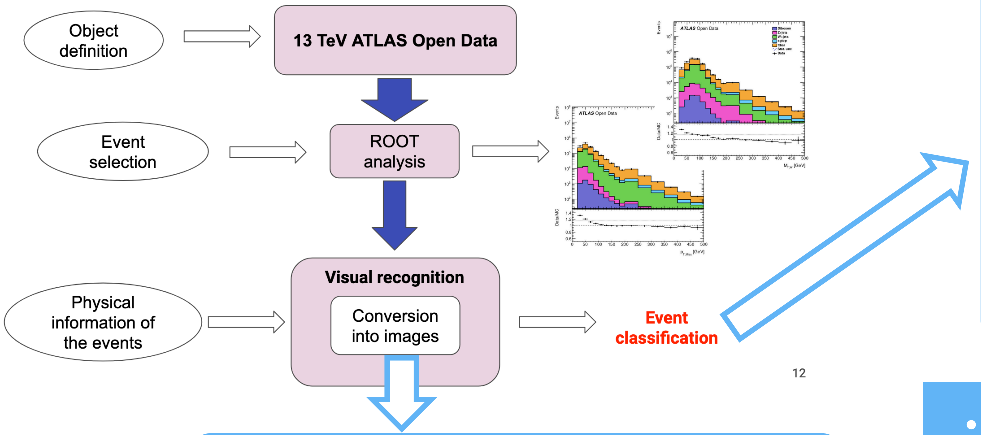
True Label \ Predicted	Wjets	tchannel	ttbar
Wjets	0.58	0.26	0.16
tchannel	0.18	0.67	0.15
ttbar	0.15	0.15	0.69

BDT



True Label \ Predicted	Wjets	tchannel	ttbar
Wjets	0.48	0.31	0.20
tchannel	0.17	0.66	0.17
ttbar	0.16	0.15	0.70

Deep Learning Classification @ LHC



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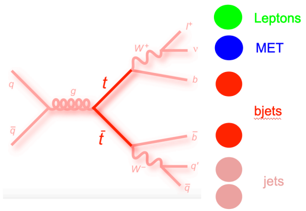

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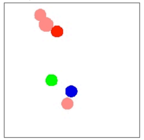
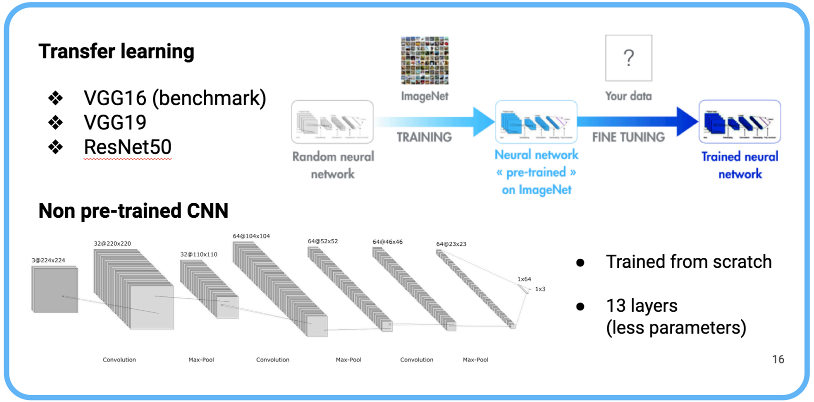
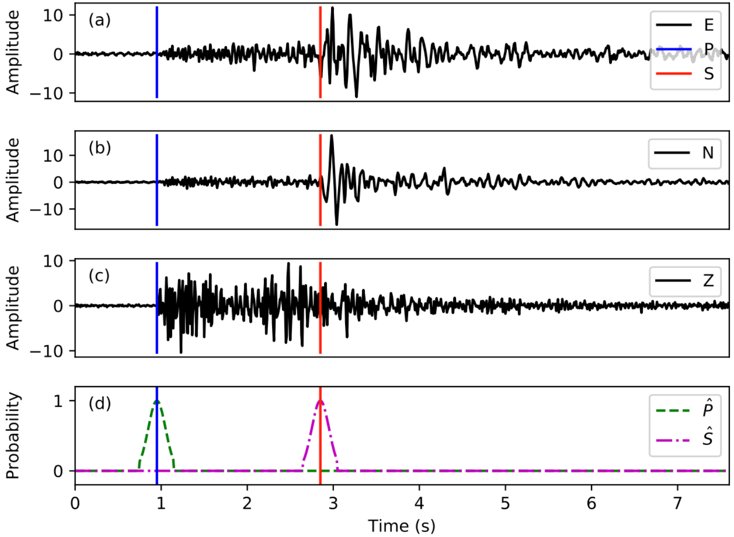




- Results in TFM of Adrían Rubio supervised by JEG, Maria Moreno, Fernando Mateo (ETSE)
- Currently looking at DarkMachines datasets to test same procedure and explore it further performance and applications.

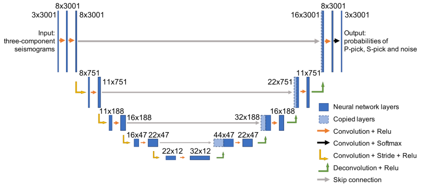
Deep Learning for Seismography

Detection of earthquakes with AI



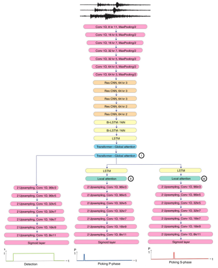
- Check of different solutions, compare and apply to the Spanish case (and different earthquakes types)

"PhaseNet"



U-Nets

"EQTransformer"



CNN+LSTM

- Check possible improvements through Transfer Learning and use of different solutions together.

Collaboration ICM-IFIC. Verónica Sanz, Carmen García and JEG + ICM

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ICM Institut de Ciències del Mar