



3rd ASTERICS-OBELICS Workshop

23-25 October 2018, Cambridge, UK.



H2020-Astronomy ESFRI and Research Infrastructure Cluster
(Grant Agreement number: 653477).

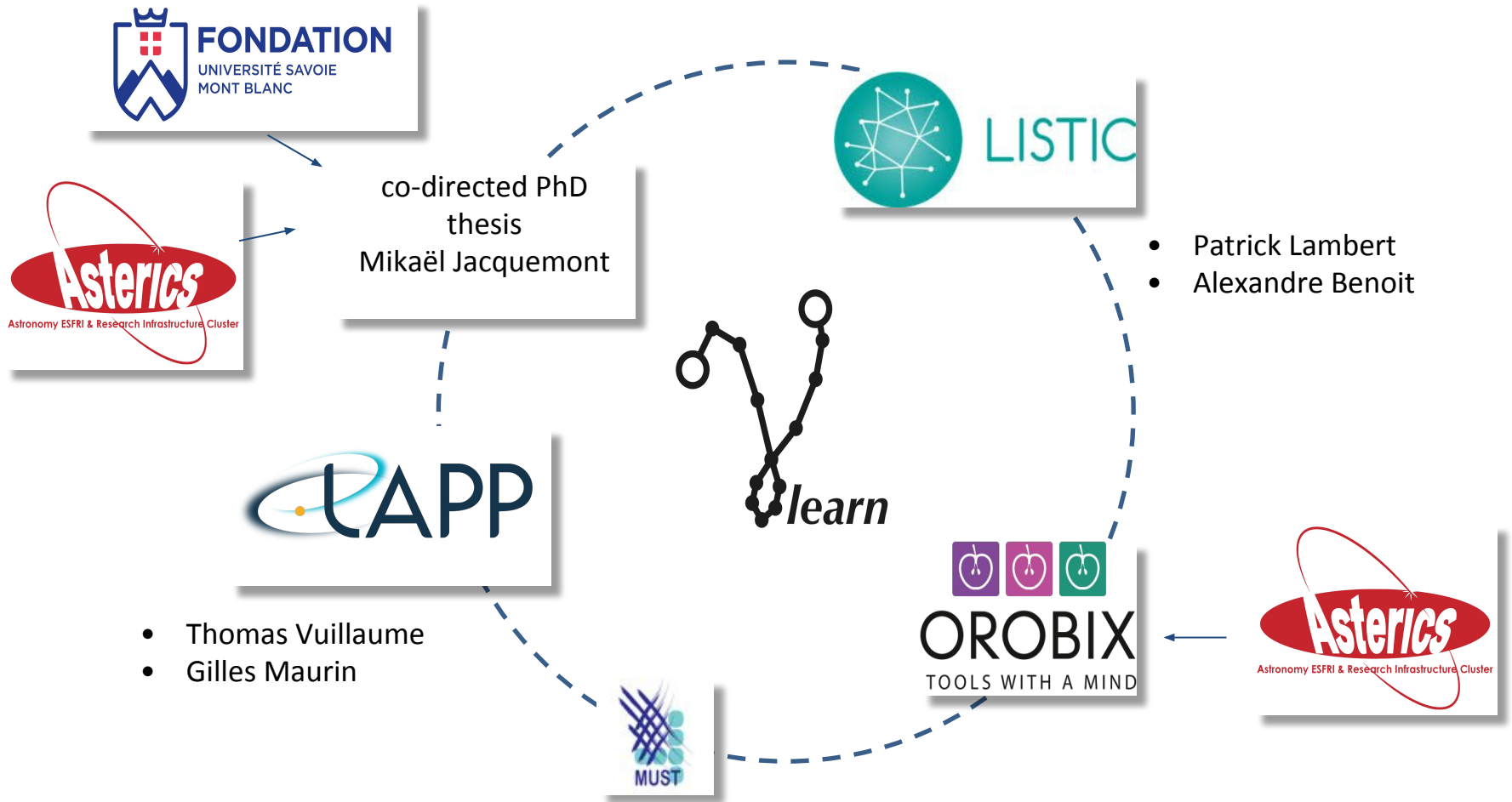


GammaLearner

A Deep Learning framework for CTA

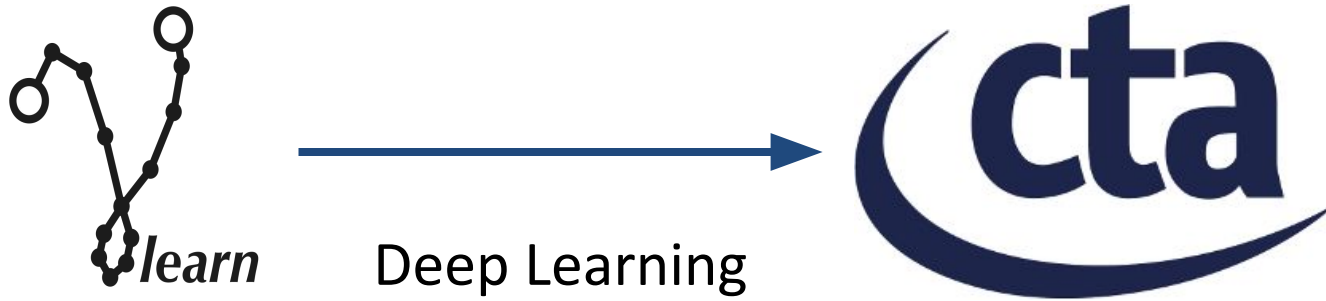
Mikaël Jacquemont*, Luca Antiga, Thomas
Vuillaume, Giorgia Silvestri, Alexandre Benoit,
Patrick Lambert, Gilles Maurin
3rd ASTERICS-OBELICS Workshop
23-25 October 2018, Cambridge, UK.

The GammaLearn project



*ASTERICS: european H2020 project

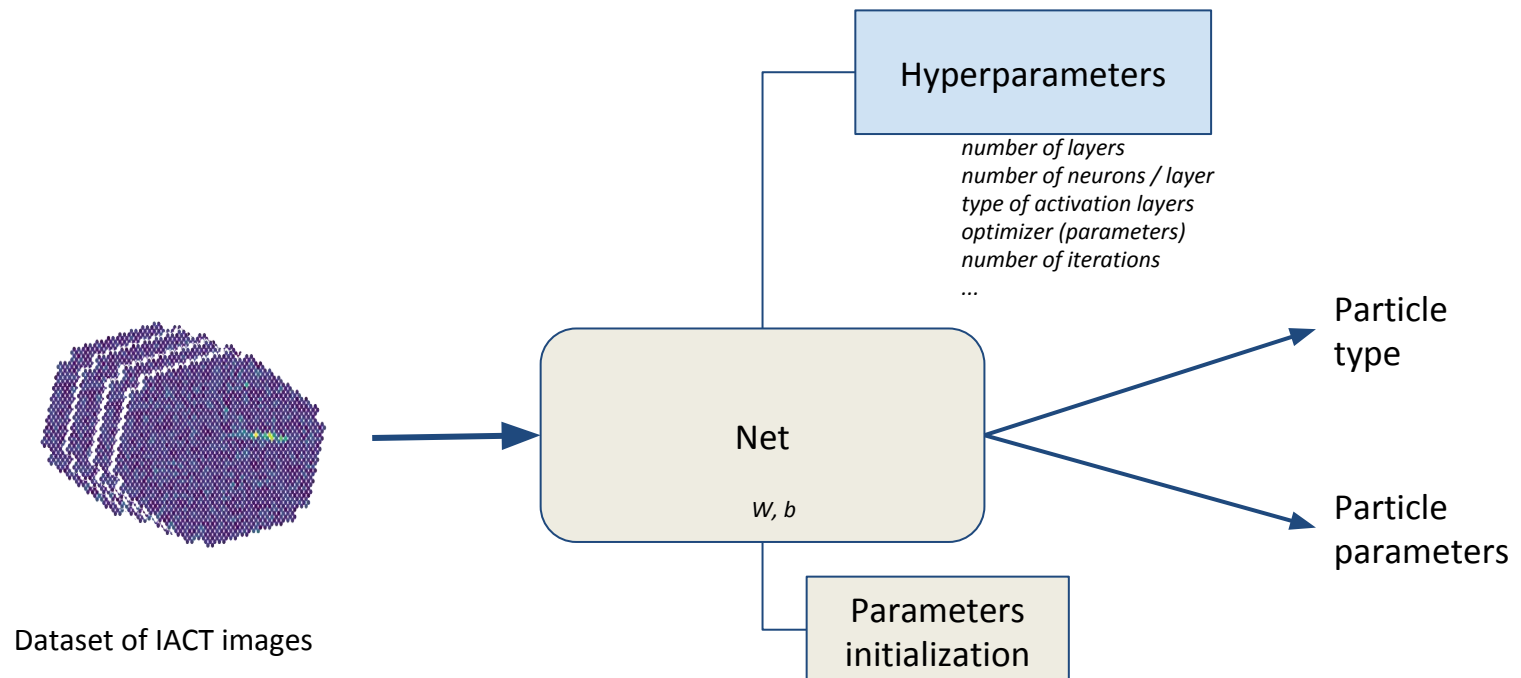
The GammaLearn Project



The GammaLearn project

Challenges

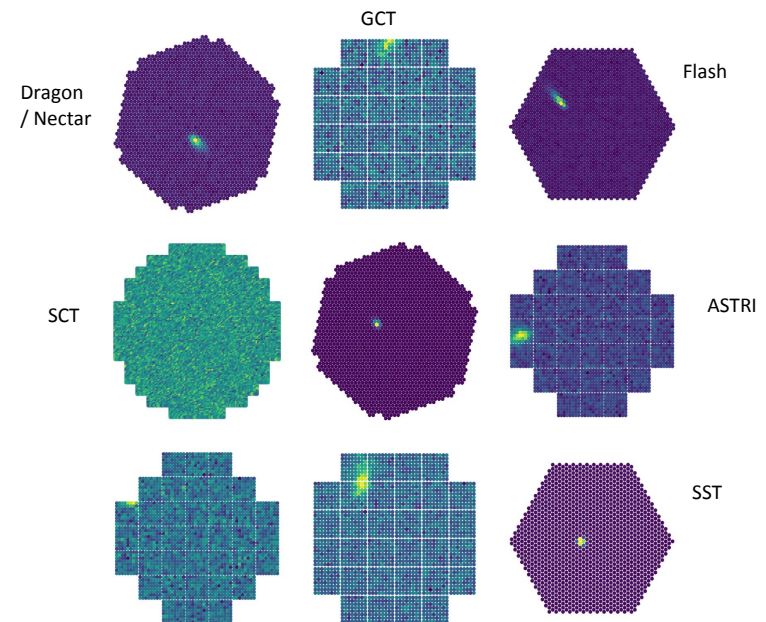
- Deep Learning
 - Iterative process: lots of experiments



The GammaLearn project

Challenges

- Deep Learning
 - Iterative process: lots of experiments
- CTA
 - Unconventional images
 - different shapes and resolutions
 - some with **hexagonal lattices**

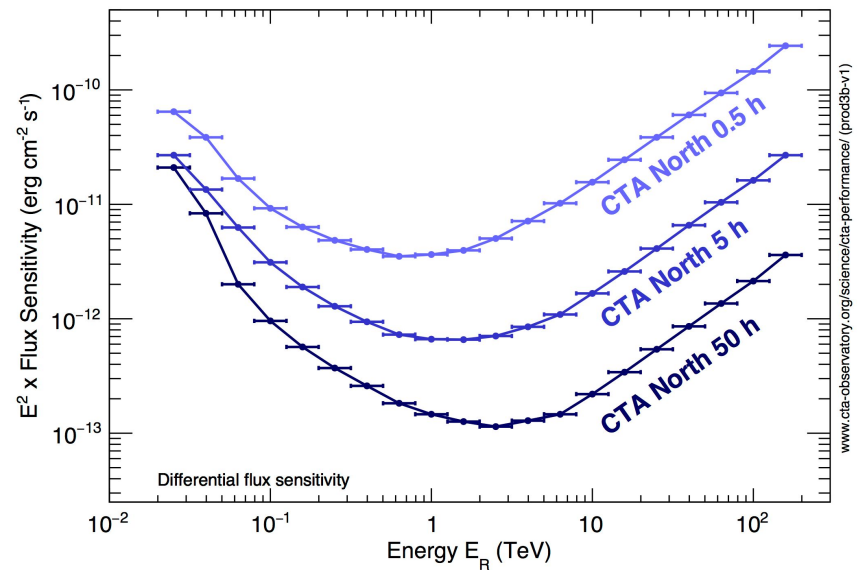
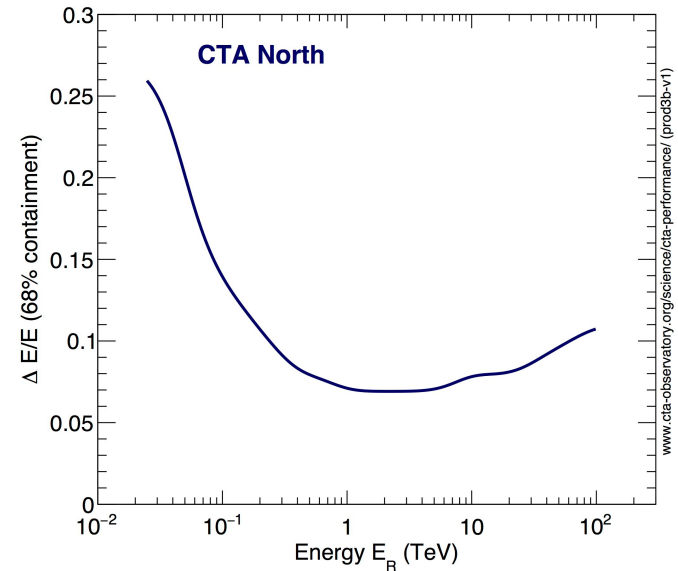


Credits: pschitt! (<https://arxiv.org/abs/1709.04675>)

The GammaLearn project

Challenges

- Deep Learning
 - Iterative process: lots of experiments
- CTA
 - Unconventional images
 - different shapes and resolutions
 - some with **hexagonal lattices**
 - Specific metrics
 - Resolution curves
 - Sensitivity curves



The GammaLearn project

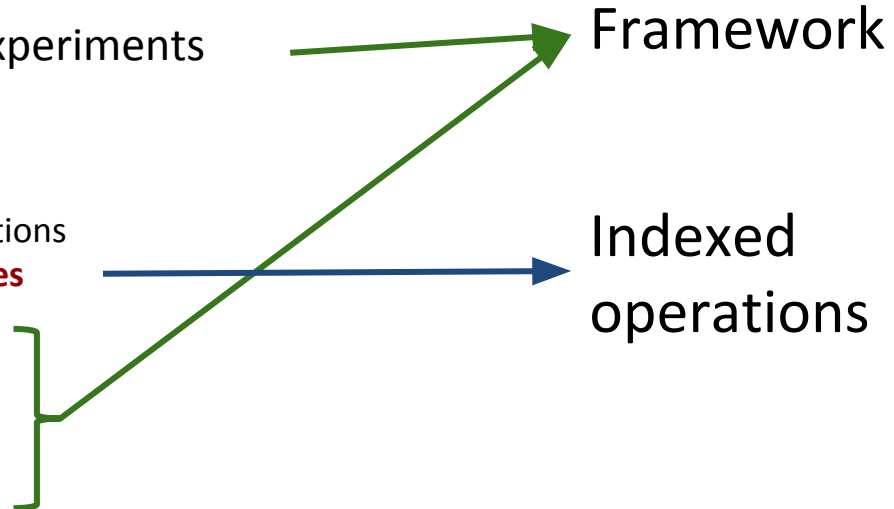
Challenges

- Deep Learning
 - Iterative process: lots of experiments
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 - Mono and stereo analysis

The GammaLearn project

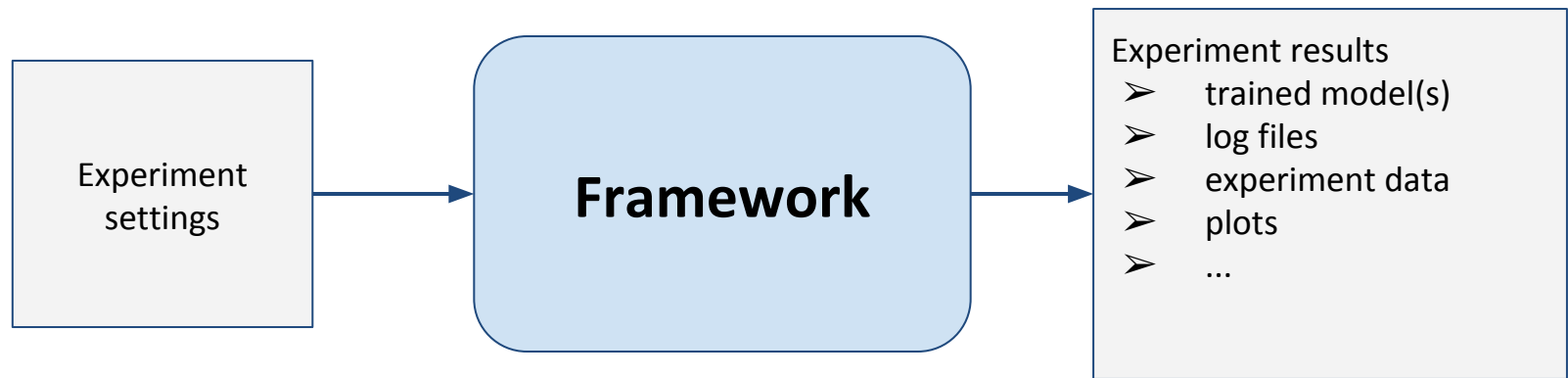
Challenges

- Deep Learning
 - Iterative process: lots of experiments
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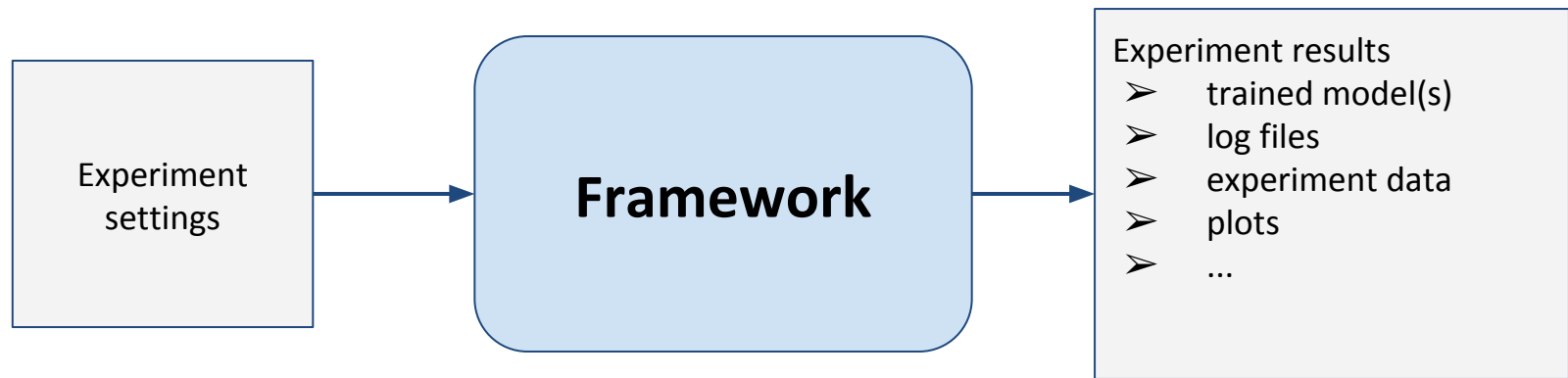
The GammaLearner framework

- Easing deep learning experiments
- Suitable to computing center



The GammaLearner framework

- Easing deep learning experiments
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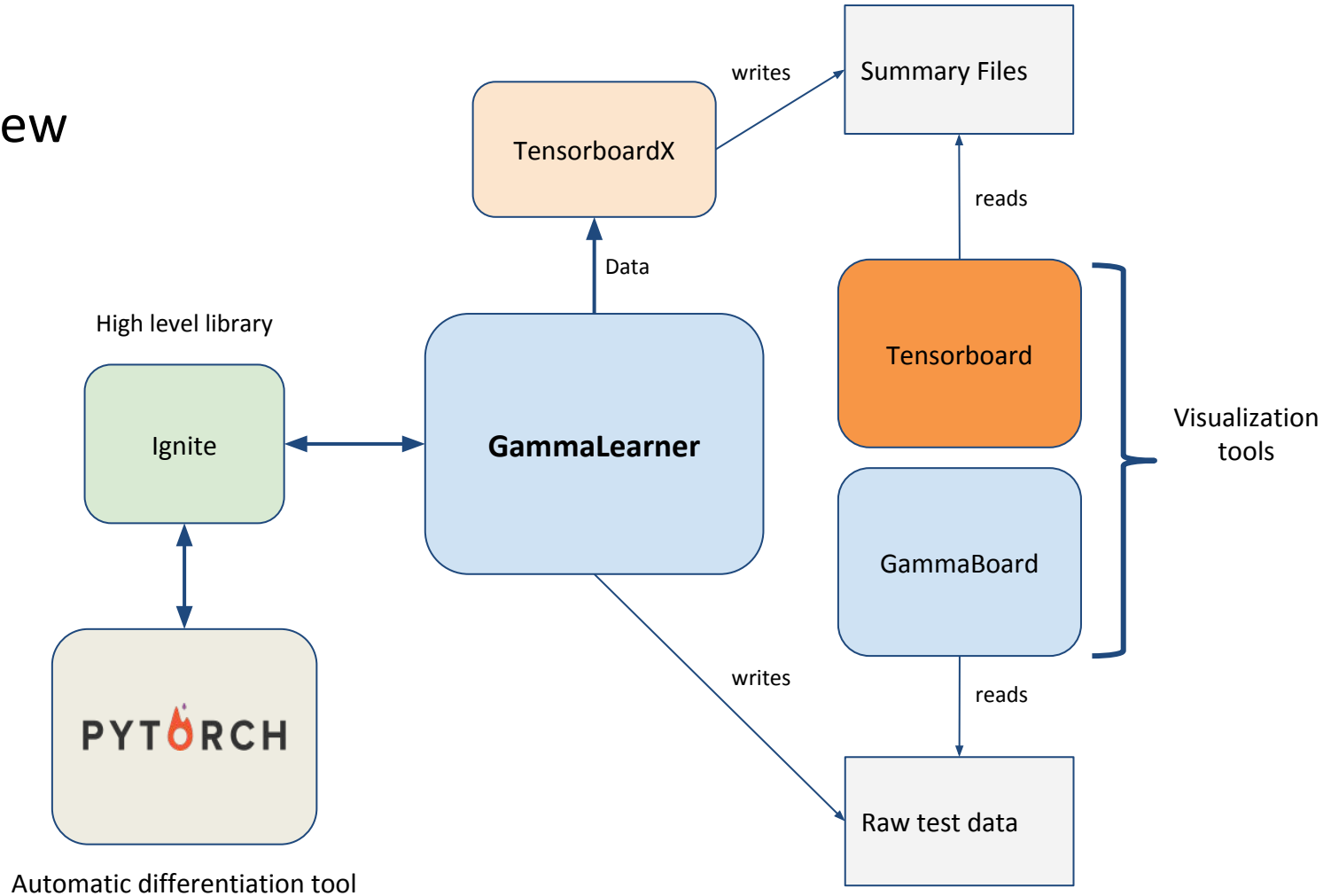


Philosophy

- Python first
- Lego like components

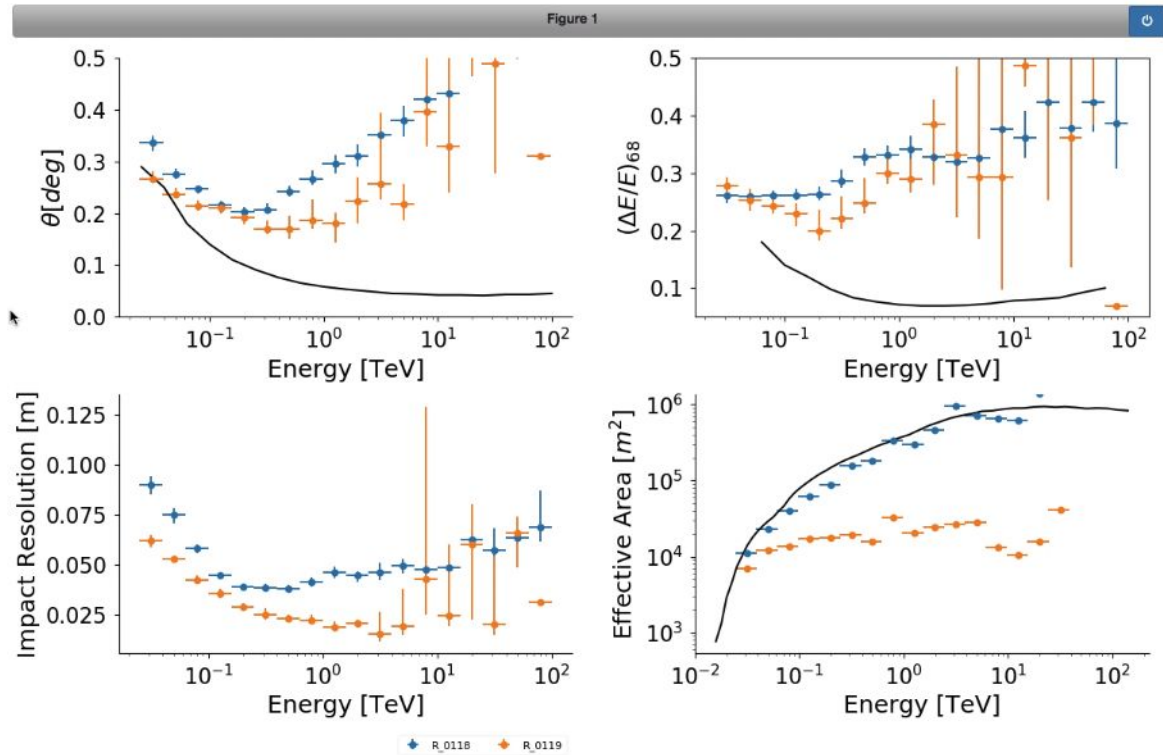
The GammaLearner framework

Overview



The GammaLearner framework

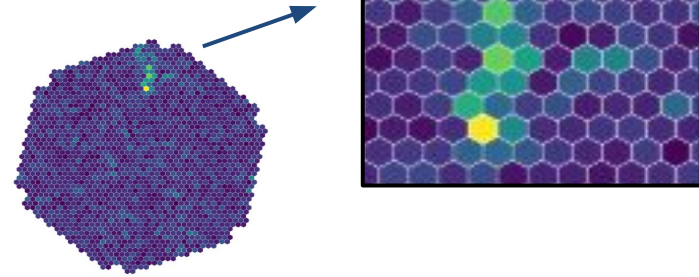
Gammaboard



R_0119	experiment ['R_0119']
R_0118	network ['GLNetIndexConvHexaPool42MultiInMultiOut']
R_0117	optimizer_parameters [{'regression': 'load_adam'}]
R_0116	optimizer_parameters [{'regression': 'load_adam'}, {'learning_rate': 0.001, 'weight_decay': 0.0001}]]
R_0115	criterion [{'energy': 'mse_loss', 'impact': 'mse_loss', 'direction': 'mse_loss'}]
R_0114	batch_size [192]
R_0113	num_epochs [100]
R_0112	filter [{"filter": [<function number_telescope_filter_memory at 0x2b7610edfae8>, <function impact_distance_filter_memory at 0x2b7610edfb70>, <function emission_angle_filter_memory at 0x2b7610edfbf8>], 'parameter': [4, 200, 0.0698]}]]
	data [{"uds_data/glearn/Data/HDF5-DL1/LaPalma/Gamma_diffuse/"}]
	[nan]
	Unnamed: 10 [nan]

Indexed operations

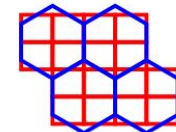
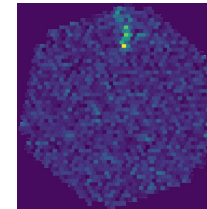
Processing unconventional images



- Other approaches

- Oversampling

- Pros: straightforward use of DL libraries
 - Cons: more data, possible distortions, pre-processing

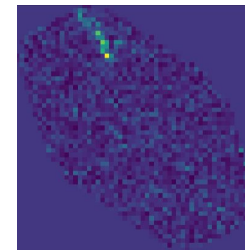


(c) oversampling

Credits: T. Holch et al.

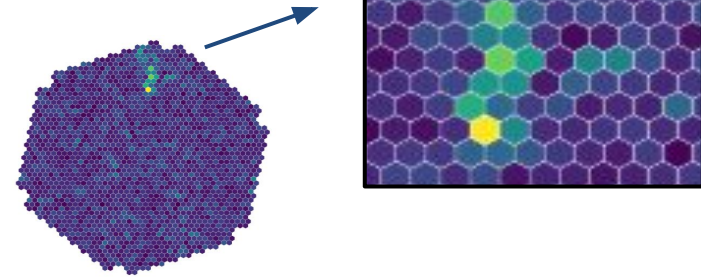
- Image shifting + masked convolution

- Pros: minor change to DL libraries
 - Cons: pre-processing, mask over-head, more data



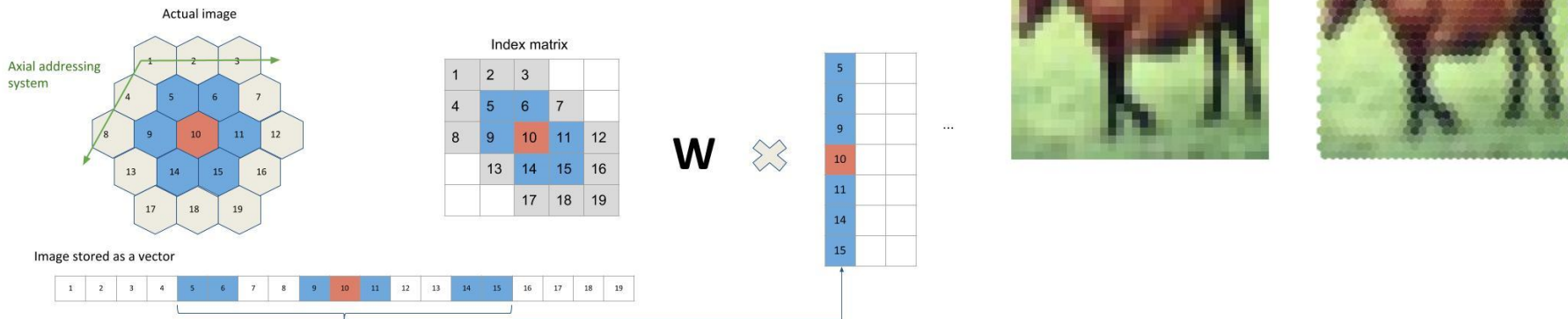
Indexed operations

Processing unconventional images



- Indexed convolution and pooling

- Validated on CIFAR and AID datasets
- Publication under preparation (VISAPP)
- Pros: process unaltered images, easily applicable to other detectors shape
- Cons: slower (Python for now)
 - C++ / cuda version version being developed



Thank you for your attention



GammaLearner framework: <https://gitlab.lapp.in2p3.fr/GammaLearn/GammaLearn>

Indexed operations: <https://github.com/IndexedConv/IndexedConv>



Acknowledgement

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