

> **15/08/2015**

Deep Learning for Imaging Calorimetry

Cern Openlab Lightning Talk
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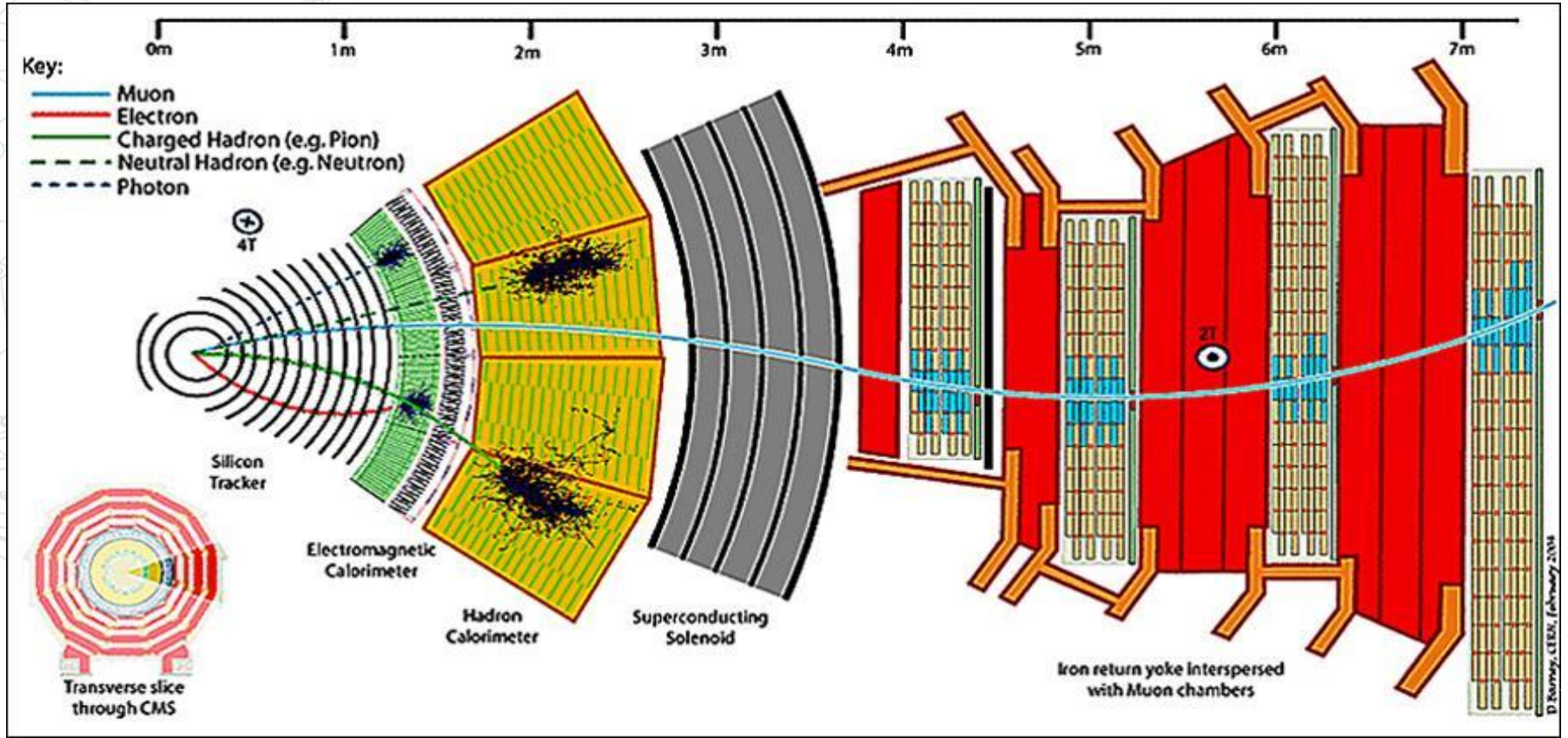
Deep Learning for Imaging Calorimetry

- › **Currently the tracker and calorimeter are used in conjunction along with physics based algorithms for particle reconstruction**
- › **There's a possibility of using deep learning algorithms on calorimeter readouts for particle reconstruction**
- › **ML algorithms can learn patterns in simulated data of CMS calorimeters (ECAL and HCAL)**
- › **Trained models can be used to classify particles and carry out regression analysis on energy of particle hits**
- › **Comparison of performance between deep learning methods vs conventional methods**

Project workflow

- › **Generate simulated calorimeter readouts of particle hits (photons and pions)**
- › **Process the calorimeter readout to find the centroid of energy deposit and take a window of reading around it**
- › **Feed the data to convolutional neural networks with varying topologies and train them**
- › **Test on unseen data and plot results**

CMS Calorimeter



The work done so far

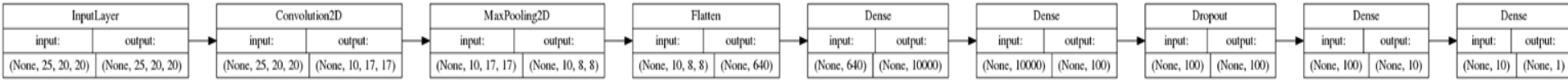
- › **Used simulated ECAL data for :-**
 - Classification between pions and photons
 - Predicting energy of photon hits on calorimeter
- › **Used different network topologies to perform classification and regression**
- › **Added HCAL data to give more information to the algorithm**
- › **Currently feeding ECAL and HCAL data into the same branched convolutional neural network to perform both regression and classification using a single network**

Some topologies used

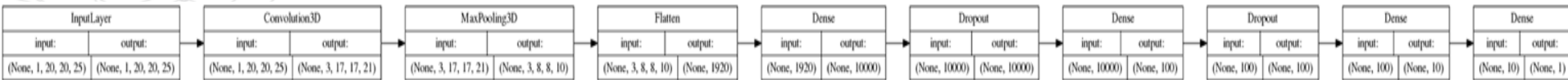
CNN1



CNN2

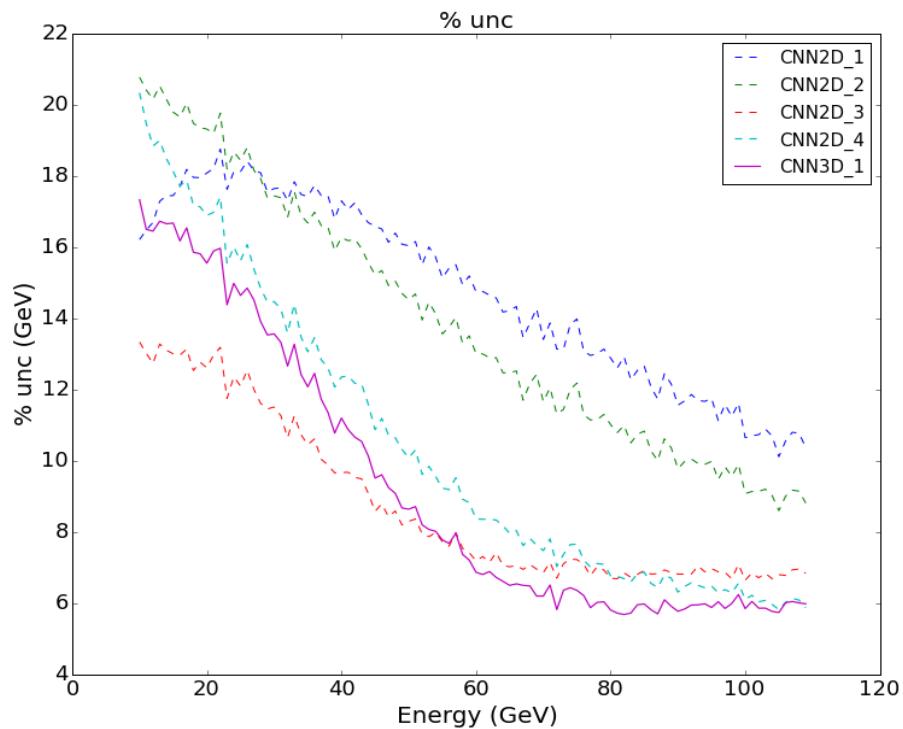
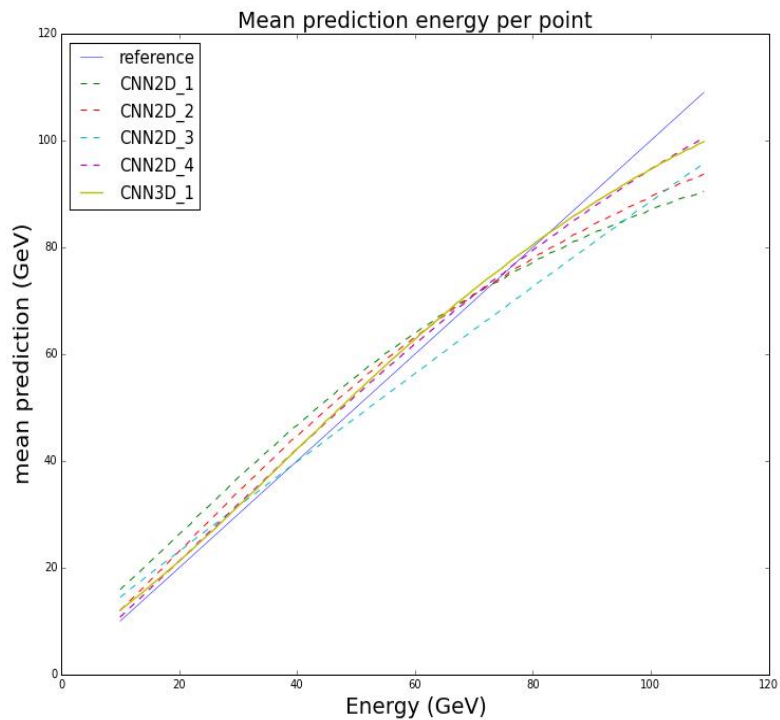


CNN3d





Some results



Future Scope of Work

- › **Classification of Jets**
- › **Publications:-**
 - Release of dataset to public
 - Release of results