

GraphNeT 2.0

A Deep Learning Library for Neutrino Telescopes

GraphNeT is a detector agnostic framework for **model development** and **deployment** in neutrino telescopes

Build, share and re-use models across collaborations

Developers: Build models and experiment with from established deep learning paradigms

Physics: Apply complex, pre-trained models to physics analyses **without being an expert** in them

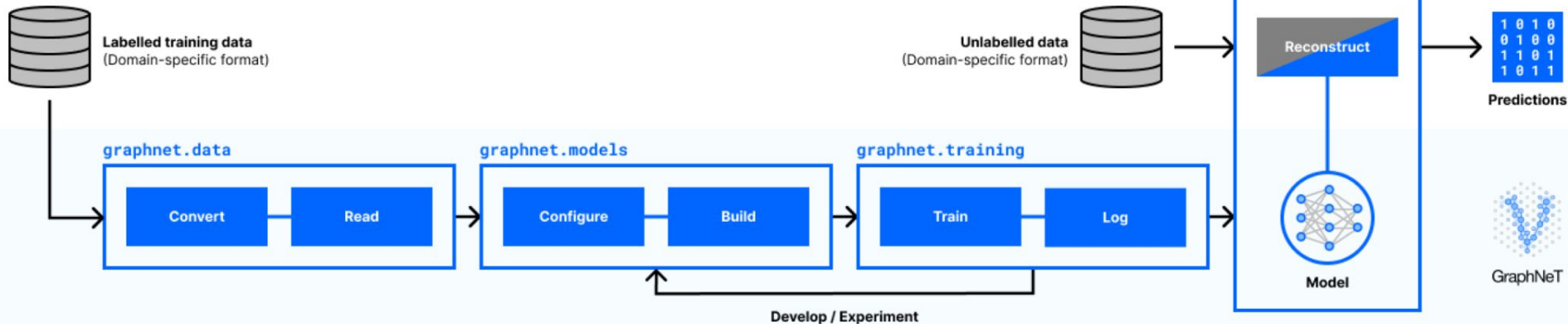
AutoEncoders

Graph Neural Networks

Convolutional Neural Networks

Normalizing Flows

Transformers



Models in GraphNeT

Models in GraphNeT are collections of reusable and swappable components that covers three main aspects of deep learning workflow:

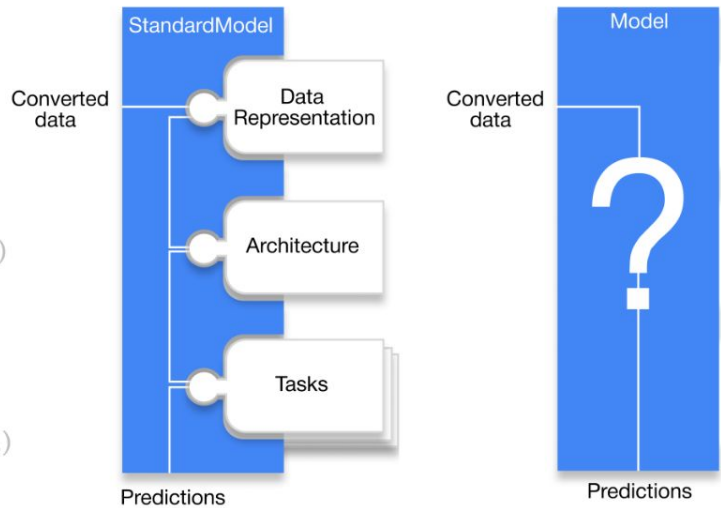
Data Representation:
Code for representing data to models.

Model Architecture:
A PyTorch model class to learn embeddings

Task(s):
The problem(s) that the model is trained to solve. Effectively a prediction head.



```
model.predict(..)  
model.from_config(..)  
model.fit(..)
```

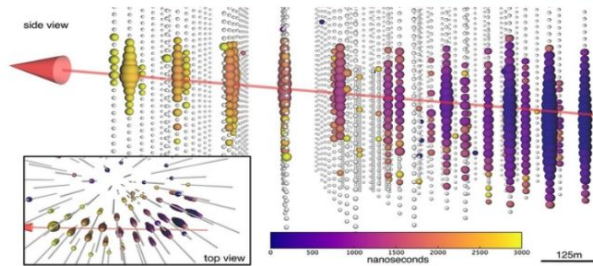


Left) StandardModel combines model components in a way that is suitable for most deep learning problems. Right) The generic Model class that provides advanced users with full freedom to define how model components should be combined.

Examples of Usage

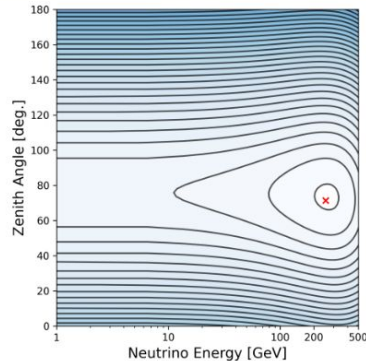


GraphNeT can be used to build and apply deep learning techniques at every step of a physics analysis



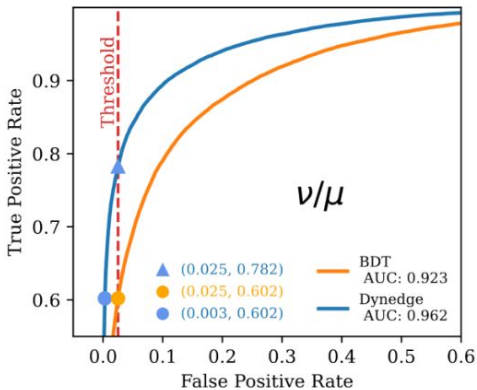
Example of a neutrino event (<https://www.ihe.ac.be/icecube>)

Learn pdfs

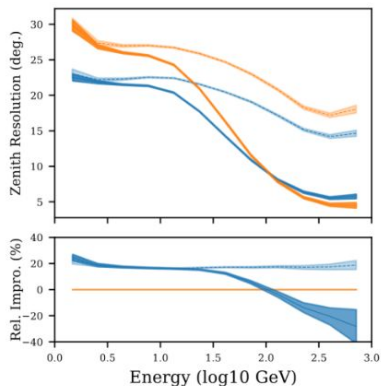


Example of using normalizing flows

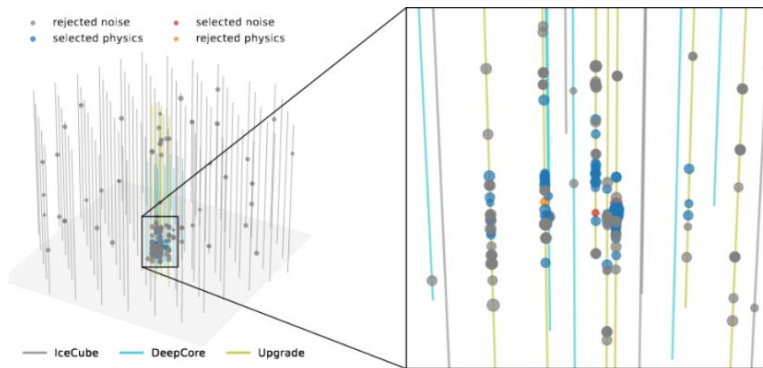
Classify events



Reconstruct labels



Remove noise



Simulated IceCube Upgrade event cleaned by a model from GraphNeT. [arXiv:2307.15295](https://arxiv.org/abs/2307.15295).

Resolution and ROC curves (blue) of models trained to reconstruct the zenith angle and distinguish between muon and neutrino events. Compared against SOTA (orange). [arXiv:2209.03042](https://arxiv.org/abs/2209.03042)

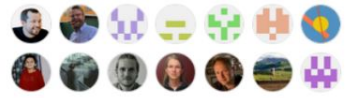


GraphNeT is a Community


graphnet
Public
Fork 84
Starred 85

GraphNeT is built by a community of deep learning enthusiasts working at the intersection of ML and neutrino physics.

Contributors 21



[+ 7 contributors](#)

Currently integrated experiments



Integration on-going for



2023, Bornholm, Denmark



2024, Munich, Germany

Two most recent annual GraphNeT Workshops. The workshops aim to bring the community together and focus on solving common problems using GraphNeT.



Getting Involved is Easy

GraphNeT is rich with community resources to get you started.

We recommend checking out

- [Colab Notebook](#)
- [Publications using GraphNeT](#)

Quick Start

PyTorch	PyTorch 2.2.*	w/o PyTorch	
Your OS	Linux	Mac	
CUDA	11.8	12.1	CPU

```
Run: git clone https://github.com/graphnet-team/graphnet.git
      cd graphnet
      pip install -r requirements/torch_cpu.txt -e .[torch,develop]
```

Snapshot of the installation matrix from the GraphNeT documentation