IceCube - Neutrinos in Deep Ice
Final Presentation

Group 12

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Machine Learning Operations

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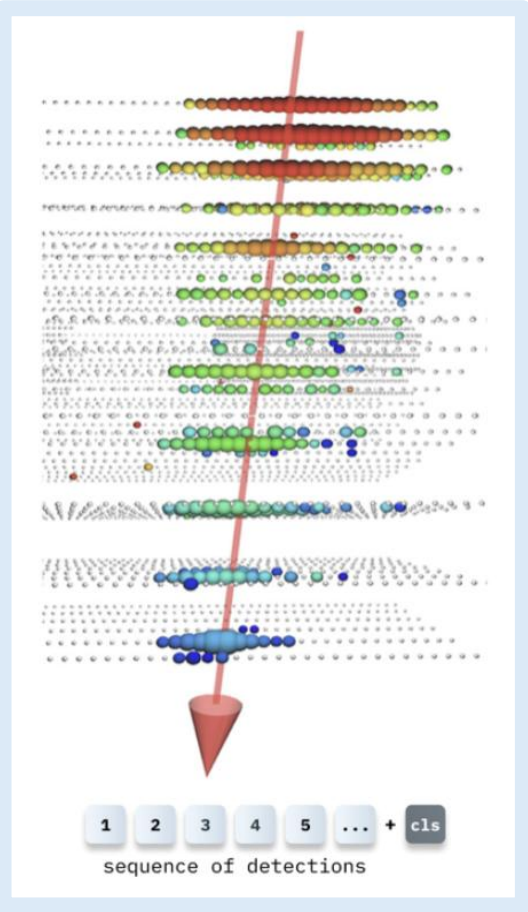
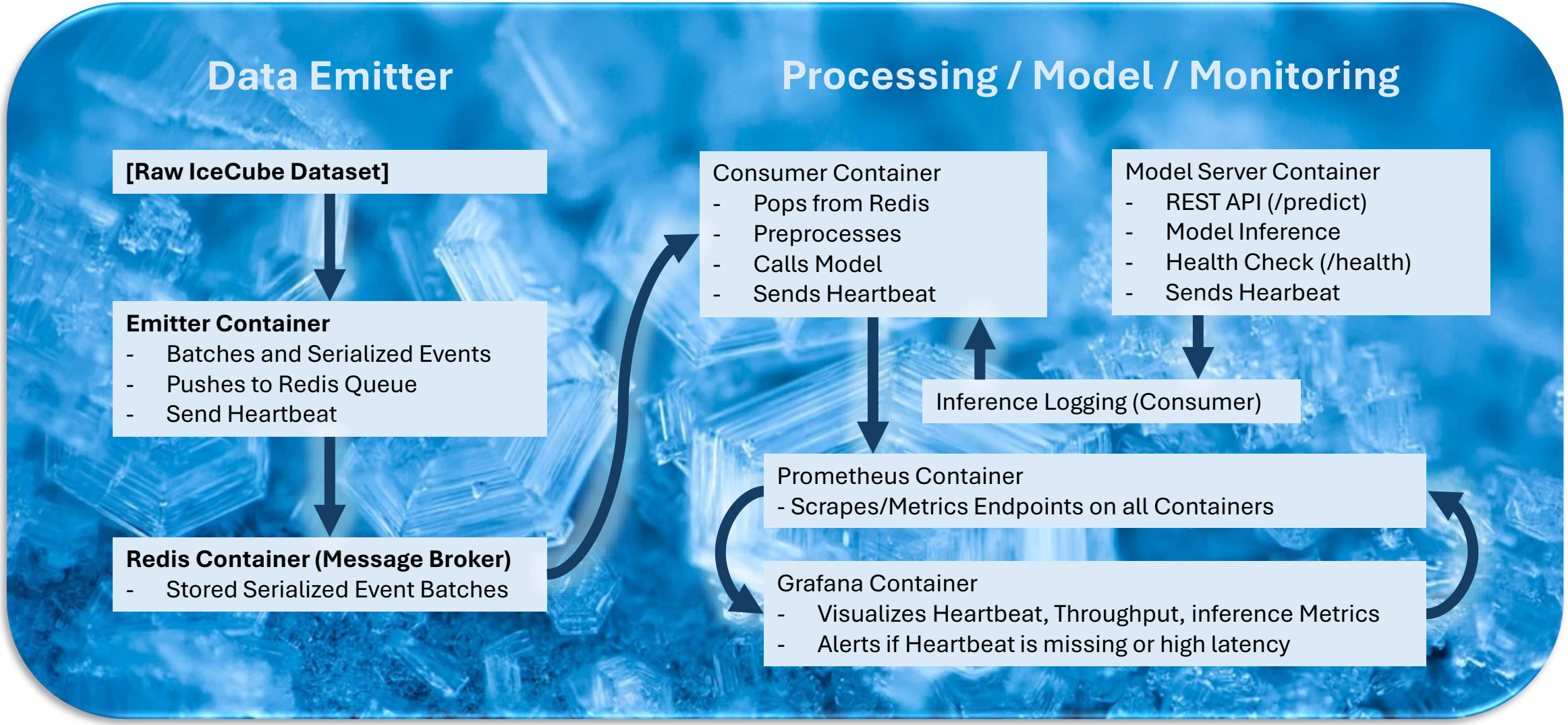
Purpose/Task of the ML System

- Neutrinos are abundant particles in our universe emitted by violent astrophysical events
- Hard to dected since they rarely interact with matter
- The IceCube Neutrino Observatory
  - A detector array spanning a cubic kilometer of Antarctic ice
  - Detects the directions of neutrino traces using photon detections (3D Unit Vector)
  - Enables determination of the neutrinos' origin, thereby helping locate astrophysical events
- Disclaimer: Our aim is NOT to optimize ML performance, but to explore how the IceCube data processing might be structured



3D Unit Vector

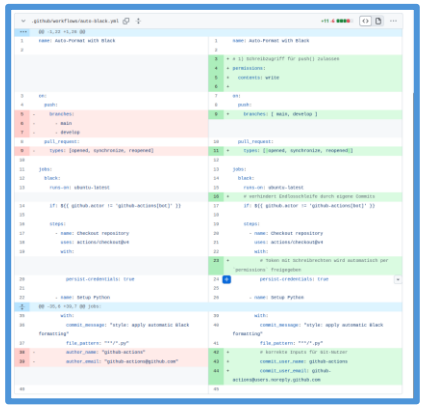
Overview of Components/Pipeline/System Setup



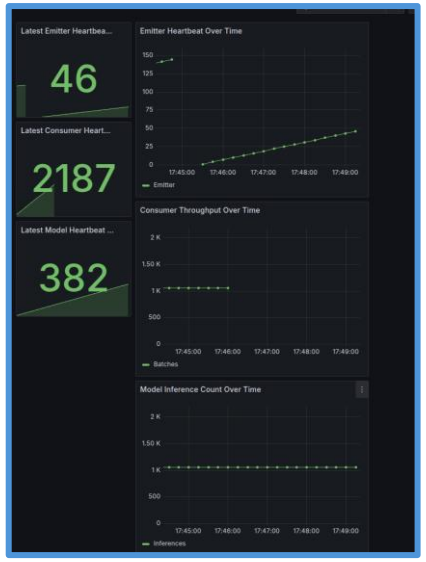
Key Features of the MLOps Pipeline [1/2]

Tool	Raison d'être
GiHub Actions	• Automatic Checks of Code Quality • Automatic requirments.txt check and update (Experimental) • Automatic Container Build and upload to GHCR
Docker	• Easy to deploy • Ensures reproducibility • Allows containerization of each component
Redis Community Edition	• Easy to use and performant que system • Relatively fast deployment
MongoDB	Used to track Events
Promotheus	• Scrapes metrics (total requests, latency, etc.) from the different containers (including heartbeat) • Can define alert rules
Grafana	• Dashboard build upon Promotheus • Displays Real Time Metrics
Flask	Server used to serve the model via REST API

Key Features of the MLOps Pipeline [2/2]

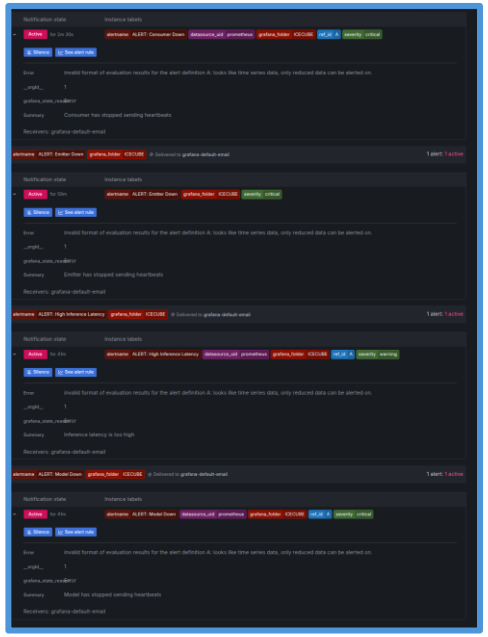


GitHub Actions

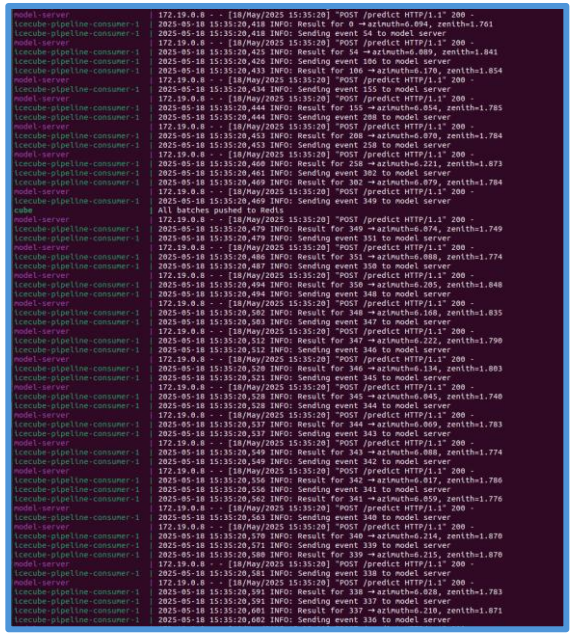


Grafana Dashboard with Real Time Insights

MongoDB for tracking Evenents



Promotheus (Eg. Automatic Alerts



«Behind the Scenes» Info Flow

Sources

- Title Slide Picture [Slide 1]
- 3D Unit Vector [Slide 3]
- Ice Pattern [Slide 3]