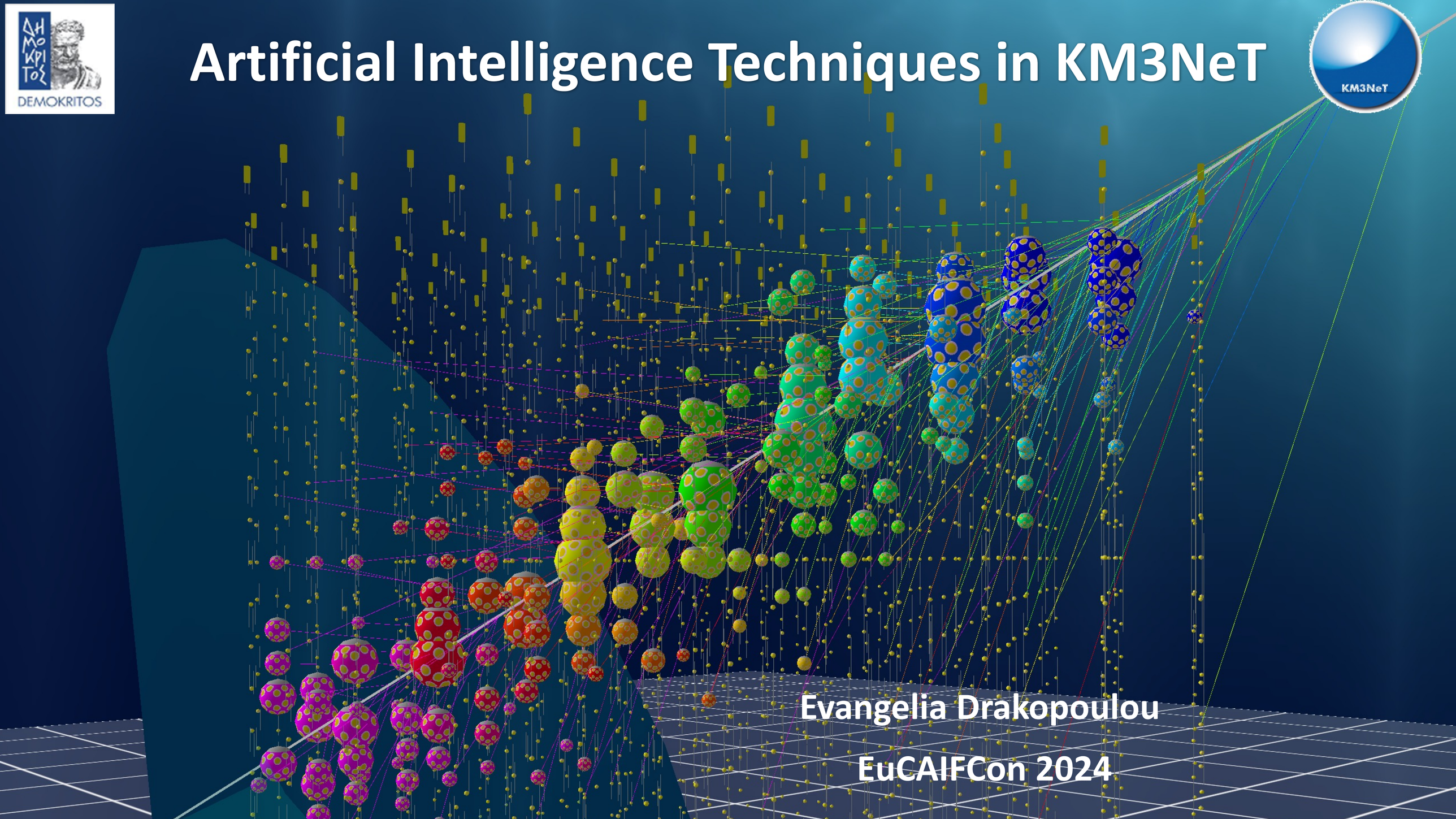
Artificial Intelligence Techniques in KM3NeT



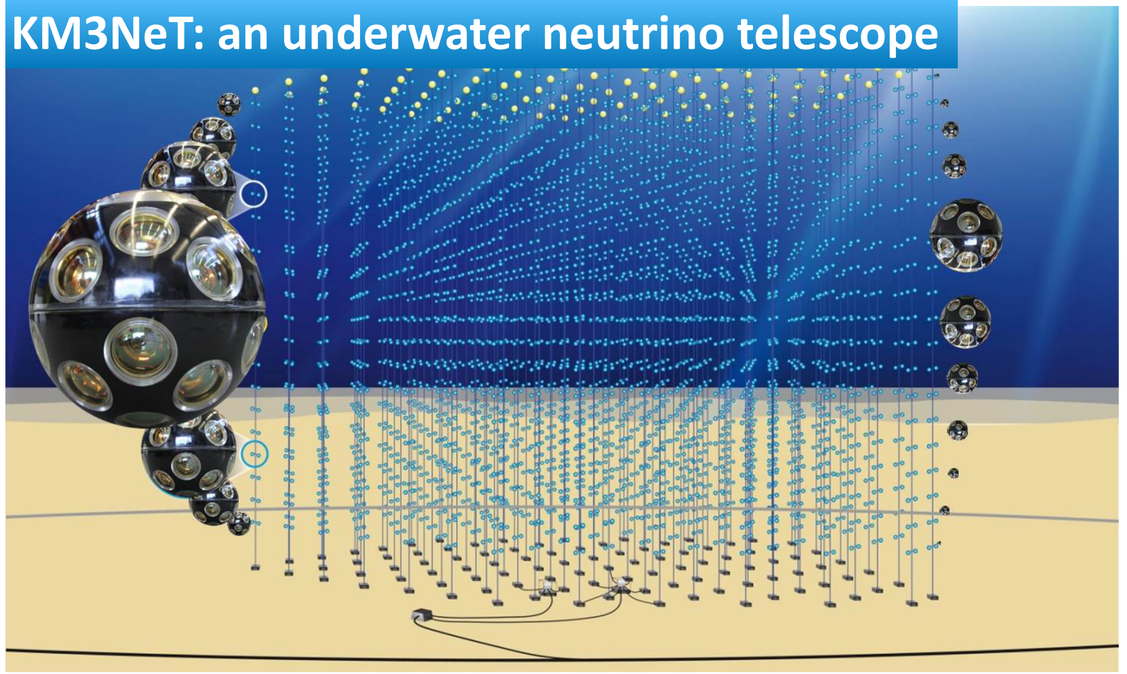
Evangelia Drakopoulou

EuCAIFCon 2024

KM3NeT: A Distributed Research Infrastructure

Identical technology for ARCA and ORCA

KM3NeT: an underwater neutrino telescope

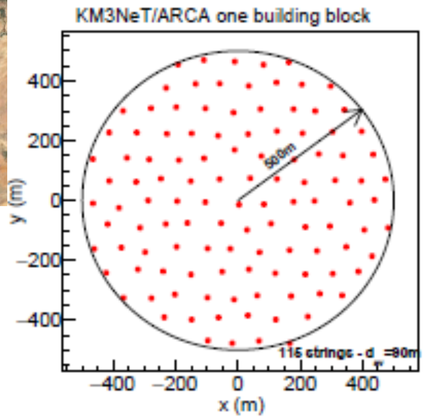


ORCA

Particle Physics
Neutrino Oscillations
Mass Hierarchy

Currently 18 DUs deployed

2x



ARCA

Detection of neutrinos from astrophysical sources

Currently 28 DUs deployed

Detection Unit (DU)

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Machine and Deep Learning Projects in KM3NeT (non exhaustive list)

GNNs:

- Development of detector calibration and graph neural network-based selection and reconstruction algorithms for the measurement of oscillation parameters with KM3NeT/ORCA (D. Guderian, PhD Thesis)
- Data reconstruction and classification with graph neural networks in KM3NeT/ARCA6-8 (F. Filippini et al., PoS(ICRC2023)1194)
- Cosmic ray composition measurement using Graph Neural Networks for KM3NeT/ORCA (S. Reck, PhD Thesis)
- Optimisation of energy regression with sample weights for GNNs in KM3NeT/ORCA (B.Setter, MSc Thesis)
- Tau neutrino identification with Graph Neural Networks in KM3NeT/ORCA (L. Hennig, MSc Thesis)

CNNs:

- Event reconstruction for KM3NeT/ORCA using convolutional neural networks (M. Moser, *JINST* 15 P10005)

Fully-connected NNs:

- Deep Neural Networks for combined neutrino energy estimate with KM3NeT/ORCA6 (S. Peña Martínez, PoS(ICRC2023)103)

and several Machine Learning-based projects (e.g. BDTs, RFs) as part of online and offline physics analyses …