

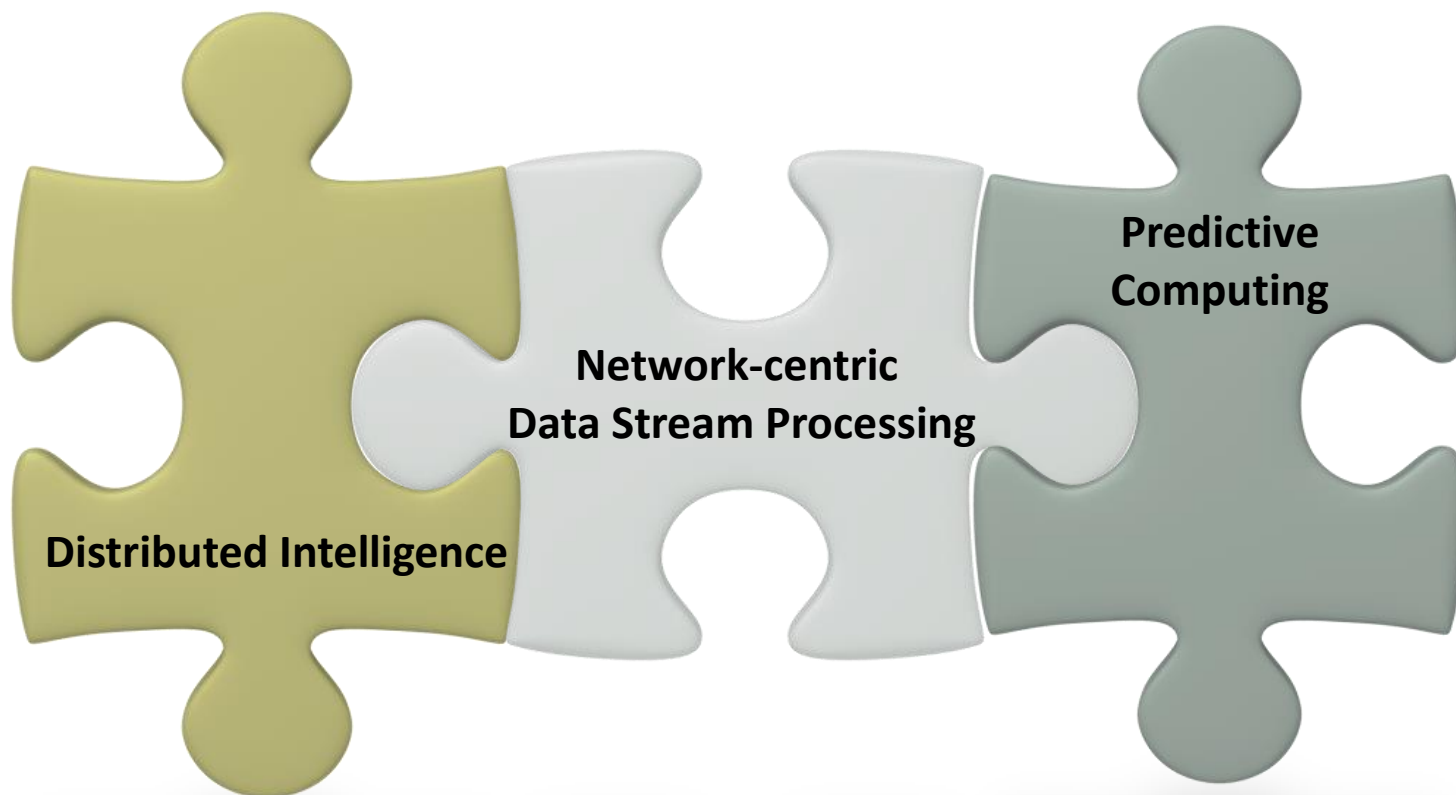
University
of Glasgow

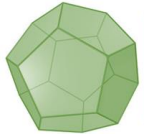
School of
Computing Science

Essence: Pervasive & Distributed Intelligence



Essence *in a* Nutshell





Network-centric Data Stream Processing

Challenge: Time-optimized Data Stream Processing

Objective: Optimally Decide **when to Process**

Funded Project: H2020/MSCA INNOVATE

❑ Methodology: Delay-Tolerant Data Stream Processing

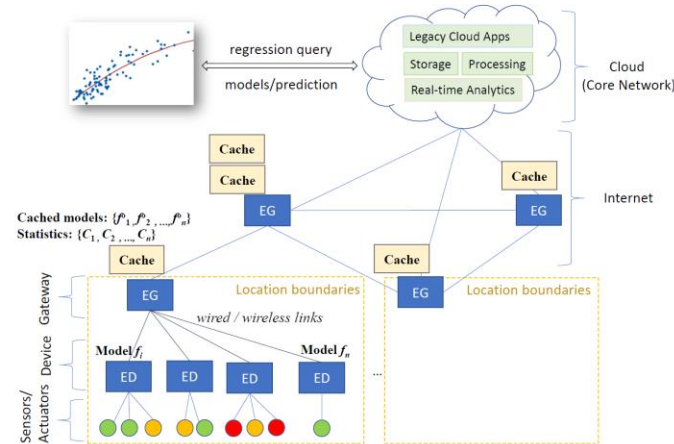
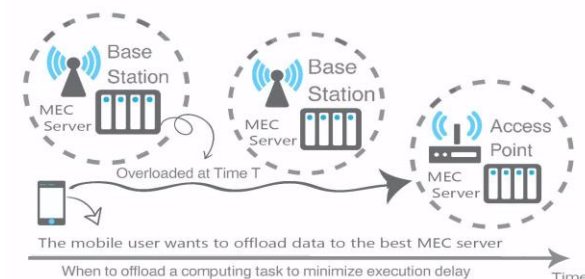
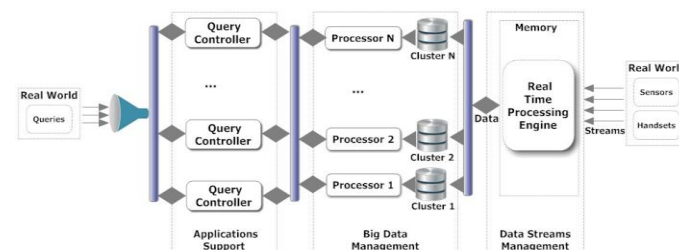
- Find the **optimal time** to infer: pattern classification; concept drift; anomaly/novelty/outliers detection,...
- Principles of **Optimal Stopping Theory**

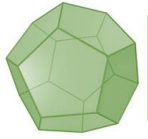
❑ Methodology: Time-optimized Task Offloading

- Find the **optimal** Mobile Edge-Computing server for task/analytics offloading

❑ Methodology: Edge-centric Selective Analytics

- Engage **only relevant** Edge Nodes for **assigning** predictive Modeling & Analytics over **relevant** local data





Distributed Intelligence at the Edge

Challenge: Energy-aware Distributed Knowledge Inference

Objective: Increase network lifetime **pushing** Inference at the Edge

Funded Project: EU/GNFUV

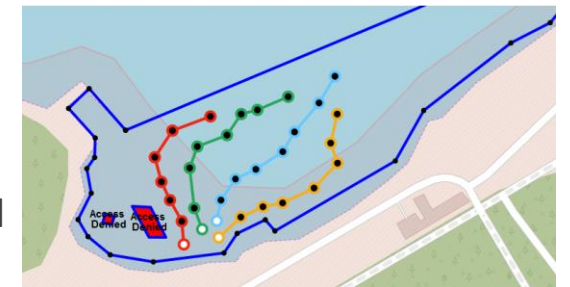
❑ **Methodology: Self-organization Algorithms** for Constrained Networks (e.g., UxVs, WSNs)

- **Particle Swarm Optimization**
- **Local Inference** and **Local Function Approximation** Models
- **Consensus** Algorithms for Knowledge/Model Fusion

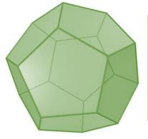
❑ **Methodology: Edge-centric Statistical Learning**

- **Exploitation:** sensing & computing capability of UxVs to **collaboratively** infer knowledge
- **Distributed** Statistical Learning Models (Model Diversity, Model Update, & Federated Learning)

Flock of USVs



USVs Experimentation Testbed
Skaramagas, Athens.



Predictive Computing

Challenge: **Dataless** Large-scale Statistical Learning

Objective: Extract Knowledge from Data **without** Data Access

Funded Project: EPSRC/CLDS

❑ Methodology: Query-driven Predictive Analytics

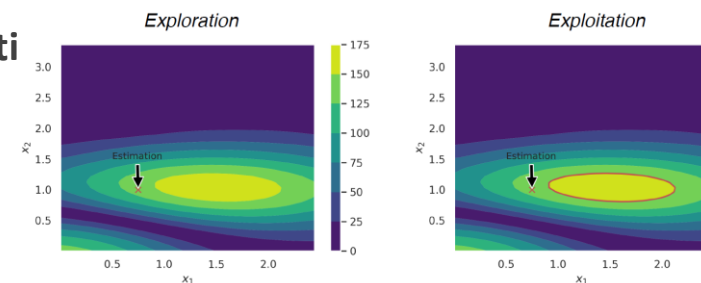
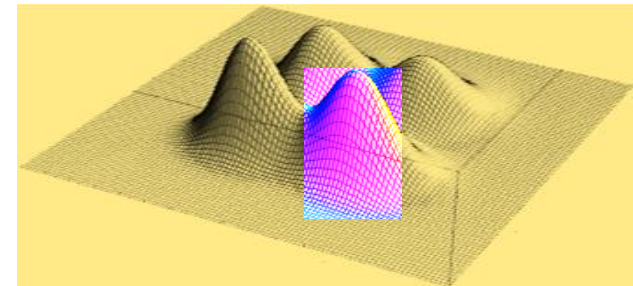
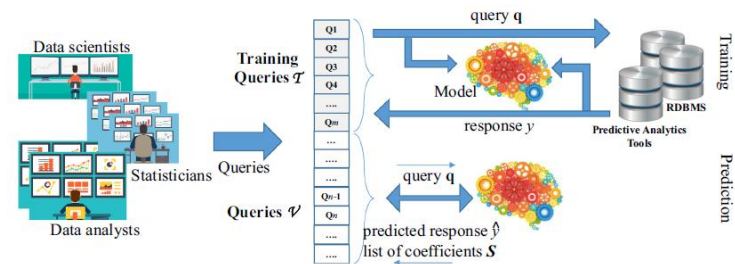
- **Predict** the query's output by **learning** from past queries
- **Benefits:** avoid query execution, reduce data transfer, optimize network & computational resources

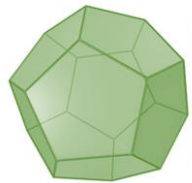
❑ Methodology: Data Relevance (Small Data **is** Big Data)

- **Key:** identify analysts' **relevant** data regions of interest
- **Key:** extract knowledge by interpolating **only** relevant data

❑ Methodology: Dataless Explanation & Exploitation of Analyti

- **Key:** exploratory analytics via sequential **learning**
- **Key:** exploit the explanation space via **computational intelligence**





ESSENCE

PERVASIVE & DISTRIBUTED INTELLIGENCE

[**http://www.dcs.gla.ac.uk/essence/**](http://www.dcs.gla.ac.uk/essence/)

Dr Chris Anagnostopoulos

christos.anagnostopoulos@glasgow.ac.uk