



Next-Gen AI Solutions for Companies: Predictive Modeling, Digital Twins & Federated AI

Tudor Cioara

Distributed Systems Research Lab

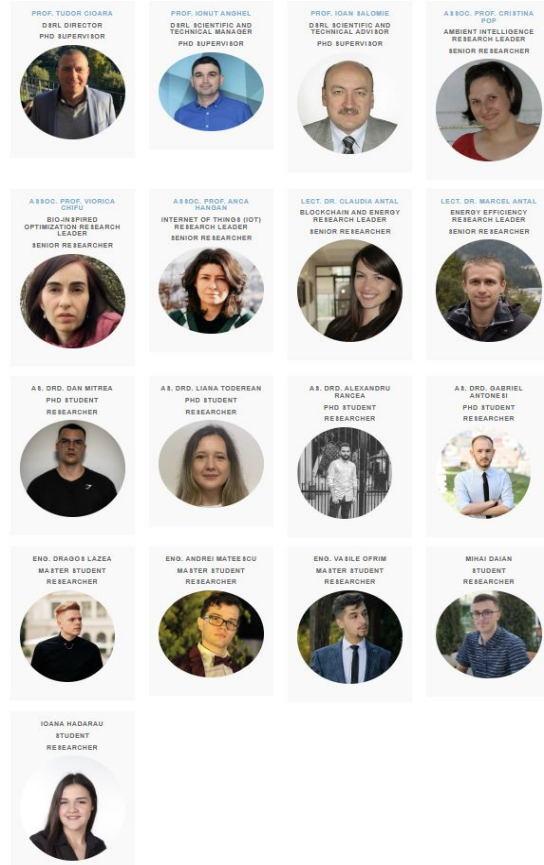
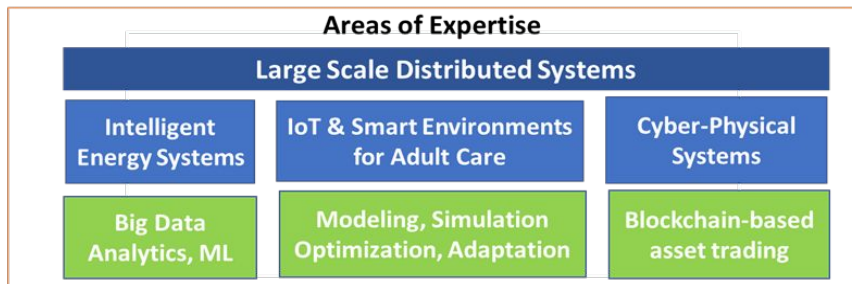
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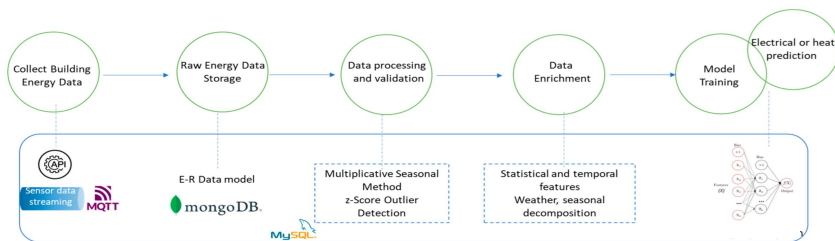
- Areas of expertise and core team





Topic 1: Prediction of operational variables

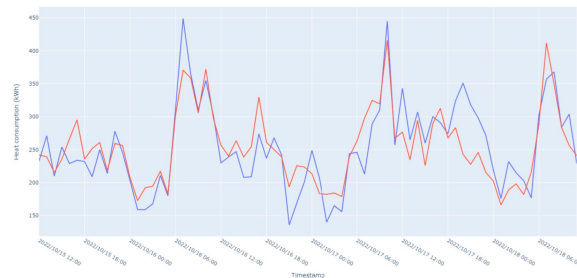
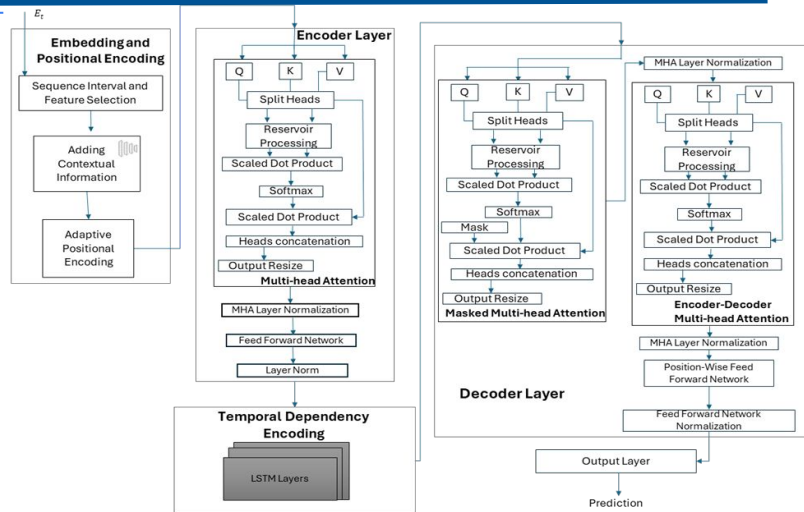
● Prediction platform for sensors data



Building Type	Prediction Model	SMAPE (%)	R ²	MAE
Apartments Building	LSTM	16.32%	0.81	57.57
	ANN	21.42%	0.69	71.66
	Basic Transformer (BT)	20.11%	0.86	62.49
	Hybrid Transformer (HT)	9.64%	0.92	36.25
Residential Building	LSTM	9.08%	0.74	0.98
	ANN	10.22%	0.72	1.08
	Basic Transformer (BT)	11.94%	0.64	1.27
	Hybrid Transformer	9.06%	0.77	0.94
Households (Portugal)	LSTM	9.63%	0.90	68.74
	ANN	10.04%	0.83	70.29
	Basic Transformer (BT)	12.6%	0.81	78.6
	Hybrid Transformer	9.26%	0.91	44.8
Commercial Building	LSTM	7.25%	0.84	7.93
	ANN	8.34%	0.78	10.24
	Basic Transformer (BT)	7.70%	0.80	9.37
	Hybrid Transformer	5.39%	0.92	6.64

Results for
energy data

Heat
demand

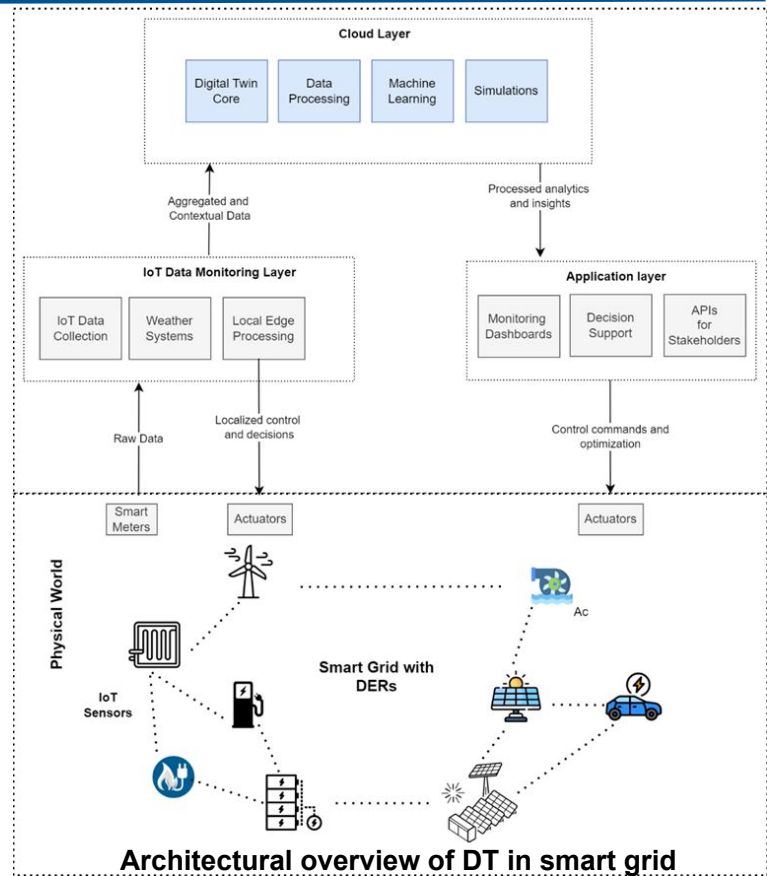
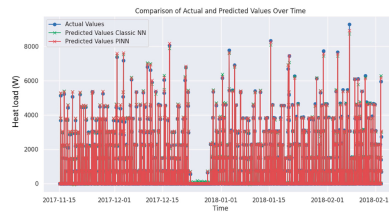
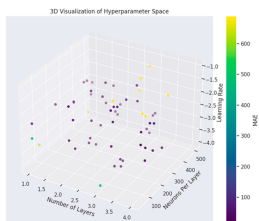
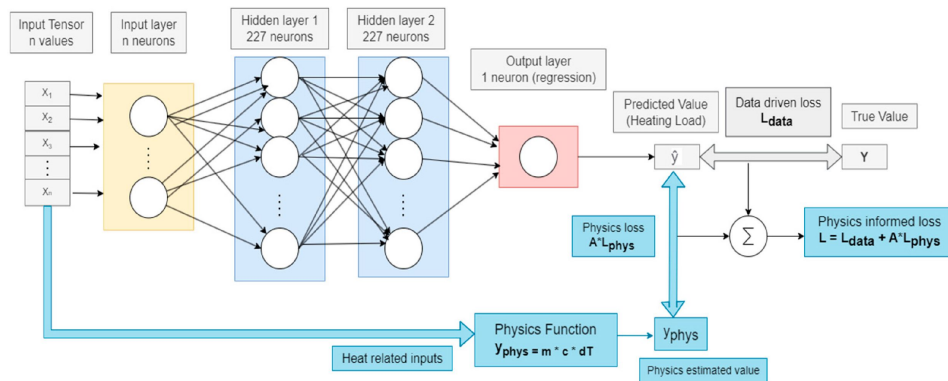




Topic 2: AI driven Digital Twins of Assets

- Modelling of non-linear processes
 - Complex industrial systems

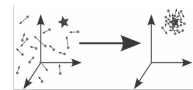
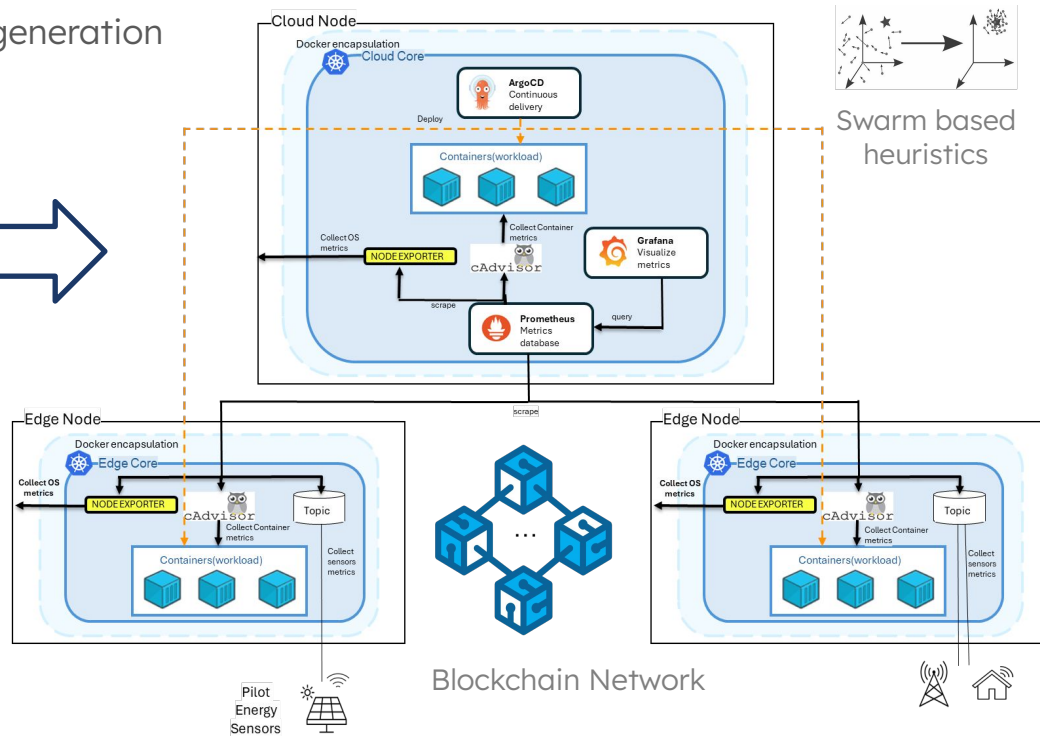
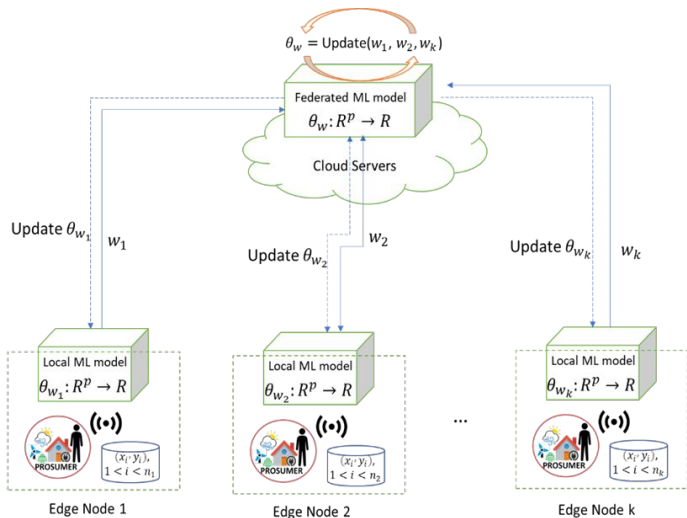
Physics informed AI model of a heat pump





Topic 3: Federated AI Orchestration

- AI Edge offloading to the point of data generation
- Federated learning models for privacy



Swarm based
heuristics





Collaboration inquiry/offer

Open for
research collaborations, joint proposals, knowledge transfer
on
Predictive Modeling, Digital Twins & Federated AI

