Eureka: Intelligent Feature Engineering for Enterprise AI Cloud Resource Demand Prediction

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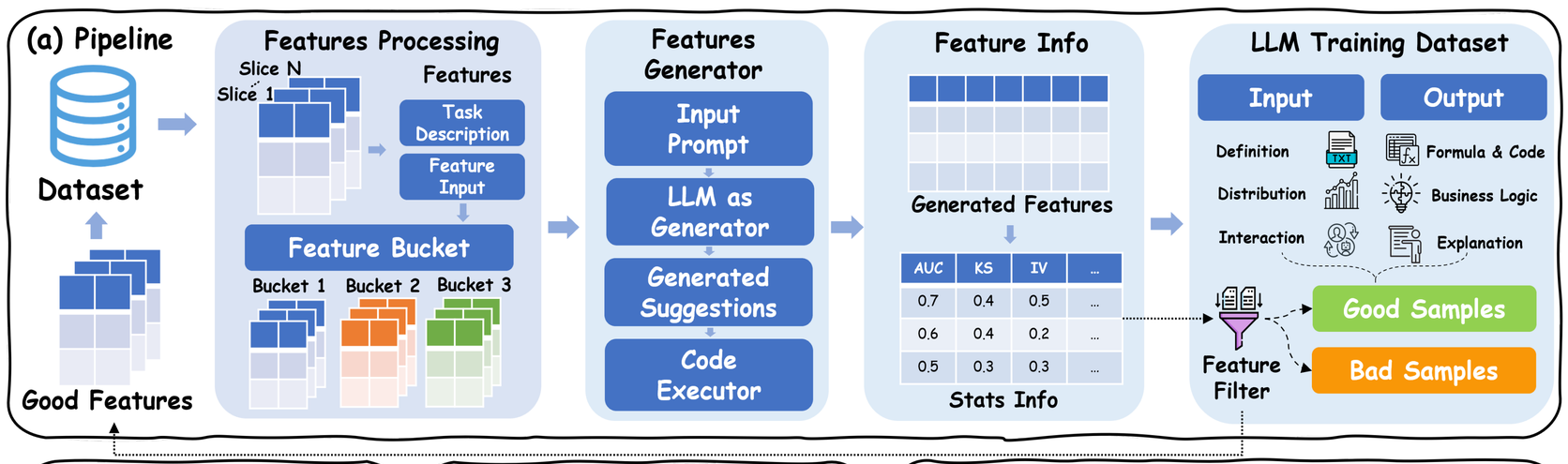
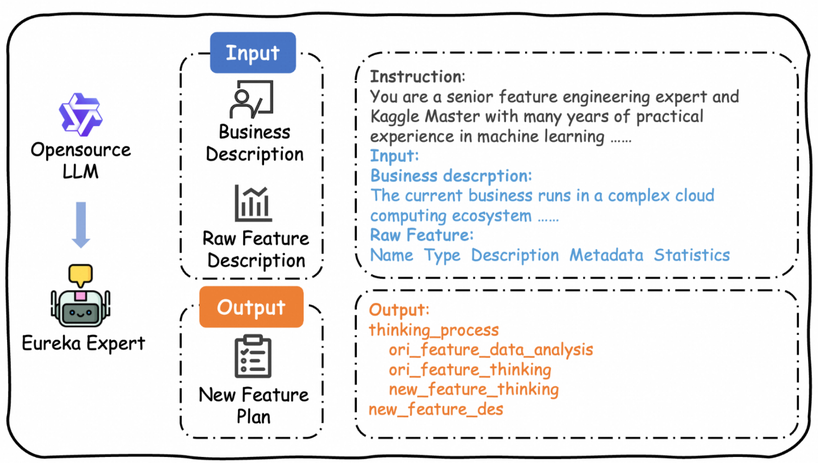
NEURAL INFORMATION PROCESSING SYSTEMS

What is Eureka?

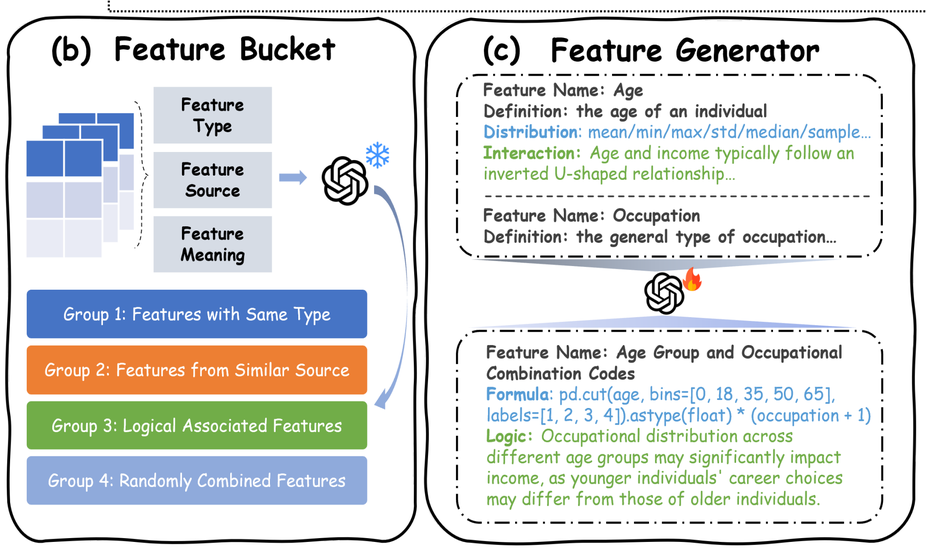
Eureka is an LLM-driven agentic framework that automates feature engineering and has three key components:

- Eureka Expert: Guides feature exploration using domain knowledge.
- LLM Feature Factory: Generates executable features from plans.
- Self-Evolving Engine: Improves features with deployment feedback.



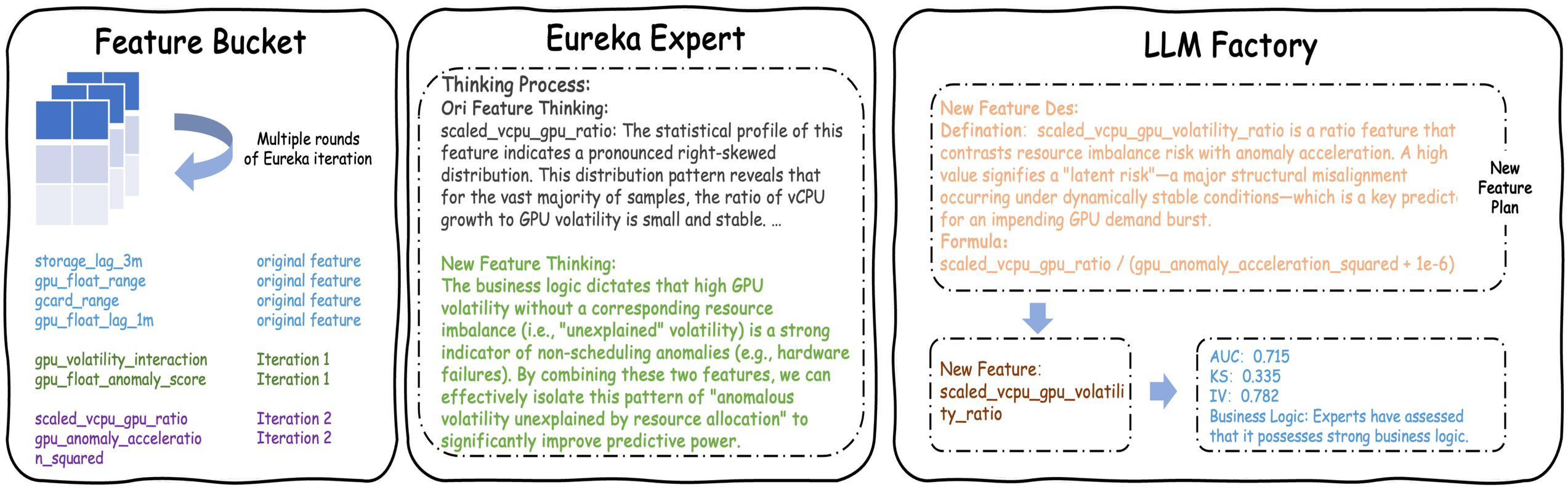


Eureka Expert



Domain-specific feature generation framework

How does Eureka work?



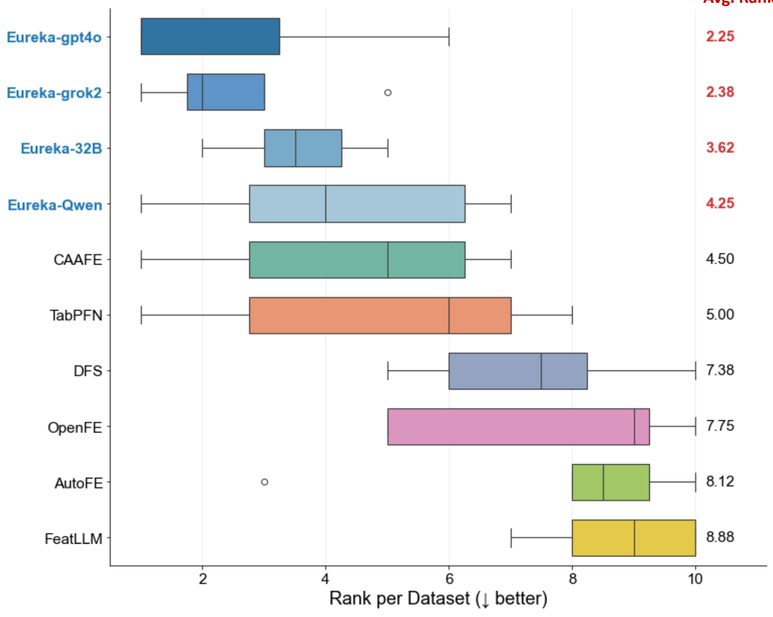
The process of obtaining high-quality features in EGS scenarios

Experimental Results

Eureka performs strongly across multiple datasets:

Method	Adult	Bank	Blood	Credit	Diabetes	Heart	Myocardial	EGS
DFS	0.915	0.897	0.637	0.707	0.882	0.921	0.654	0.68
AutoFE	0.872	0.865	0.735	0.676	0.837	0.903	0.674	0.666
OpenFE	0.92	0.923	0.626	0.701	0.817	0.897	0.697	0.658
TabPFN	0.9	0.904	0.715	0.787	**0.888**	0.938	0.676	0.694
CAAFE	0.901	0.905	0.713	0.797	0.886	**0.941**	0.686	0.692
FeatLLM	0.894	0.851	0.678	0.743	0.811	0.881	0.663	0.675
Eureka-Qwen	0.926	0.932	0.738	0.794	0.873	0.926	**0.737**	0.679
Eureka-32B	0.926	0.932	0.716	0.824	0.884	0.936	0.711	0.688
Eureka-gpt4o	**0.928**	**0.934**	**0.745**	**0.838**	0.881	0.938	0.699	**0.699**
Eureka-grok2	**0.928**	**0.934**	0.735	0.815	0.886	0.940	0.719	0.686

Methods Rank:



Ablation results

Configuration	ROC-AUC(%)	Δ vs Eureka(%)
Eureka	69.97	--
w/o Self-Evolving Engine	69.45	-0.52
w/o Eureka Expert	65.91	-4.06
w/o LLM Factory	63.84	-6.13

Quantifiable business impact

Impact Area	Key business metric	Improvement
Operational adoption	Adoption rate of generated warnings	91%
Demand fulfillment	Demand fulfillment rate (top-tier customers)	+16%
Resource efficiency	Reduction in server migration loss rate	-33%

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