

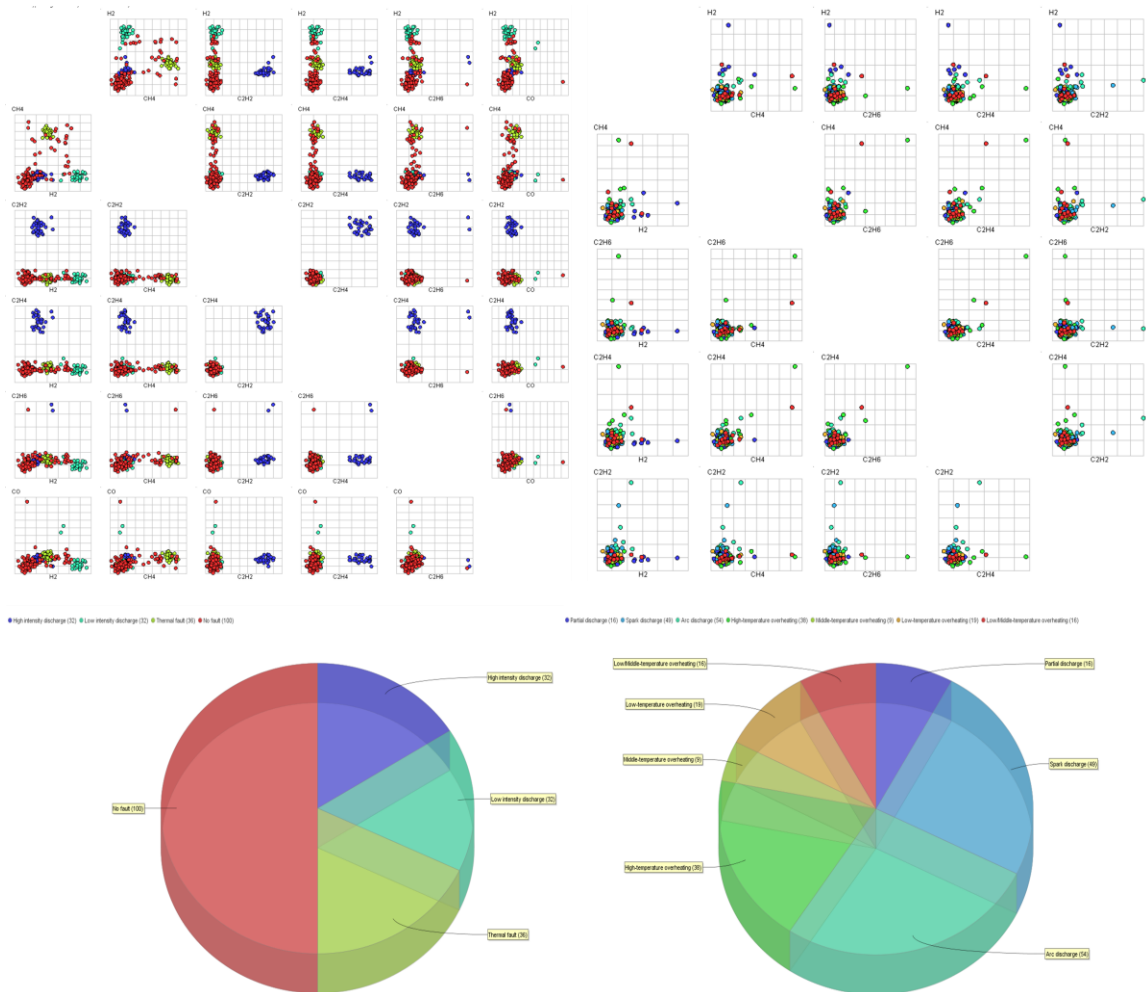
Supplementary Materials of paper

An AI-layered with Multi-Agent Systems Architecture for Prognostics Health Management of Smart Transformers: A Novel Approach for Smart Grid-Ready Energy Management Systems

Datasets Folder: Contains 4 datasets

-5 Gas 7 Labels Dataset

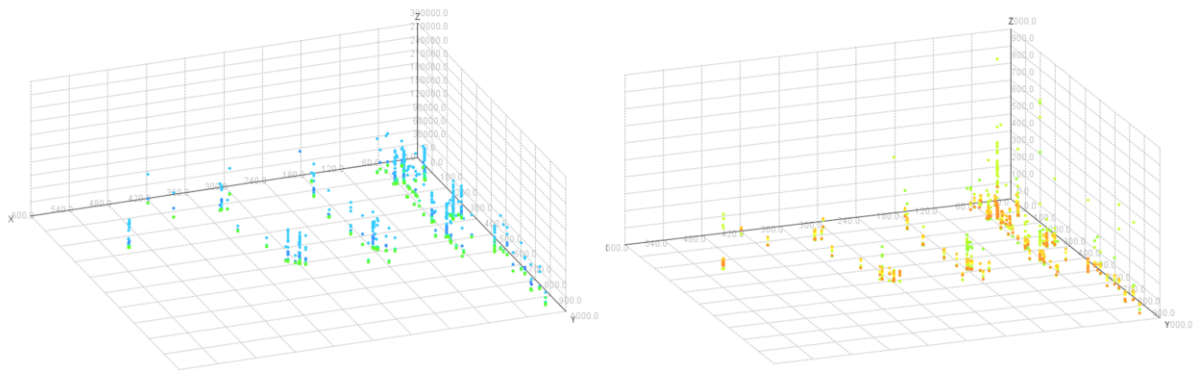
-6 Gas 4 Labels Dataset



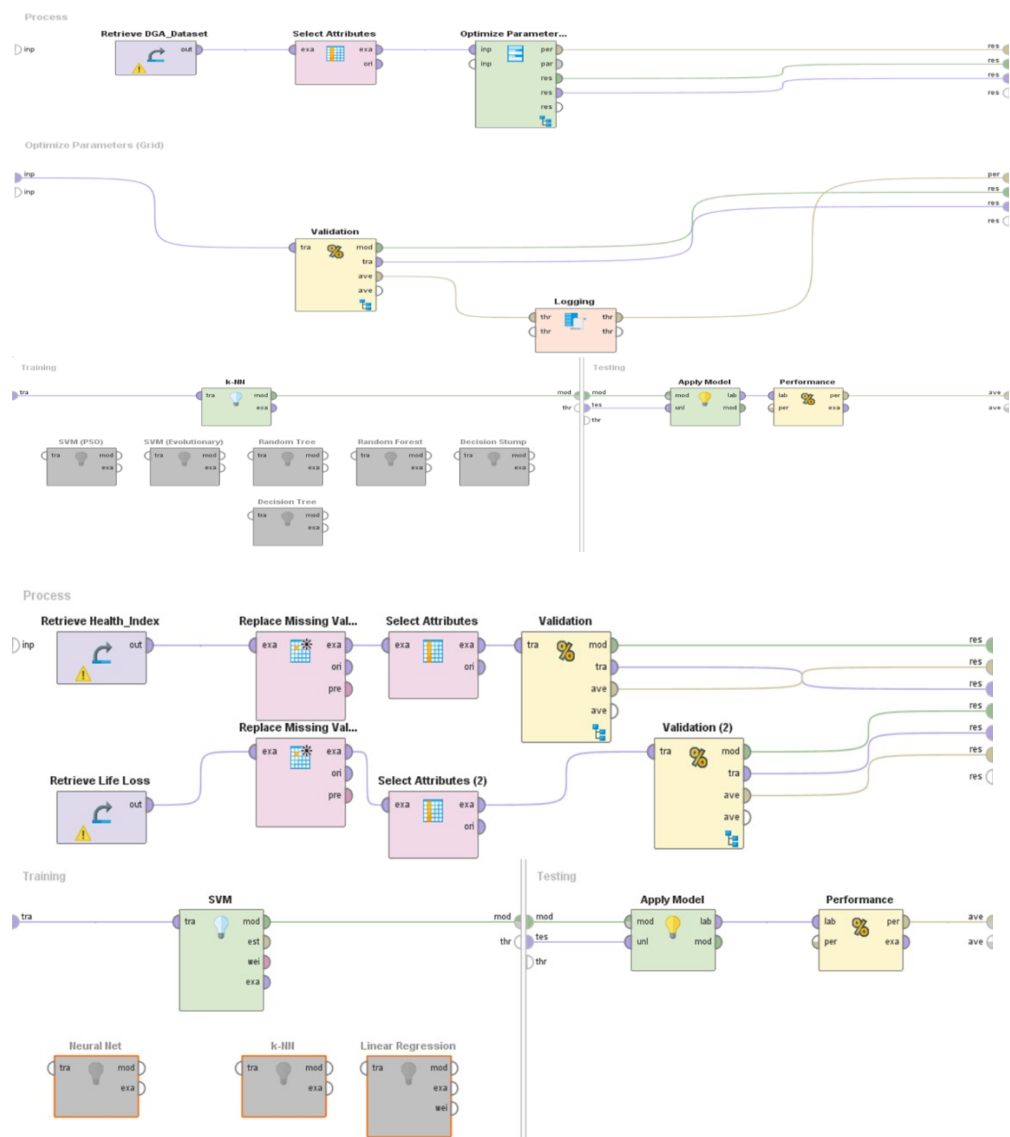
-Health Index Scoring Dataset

-Life Loss Calculation Dataset

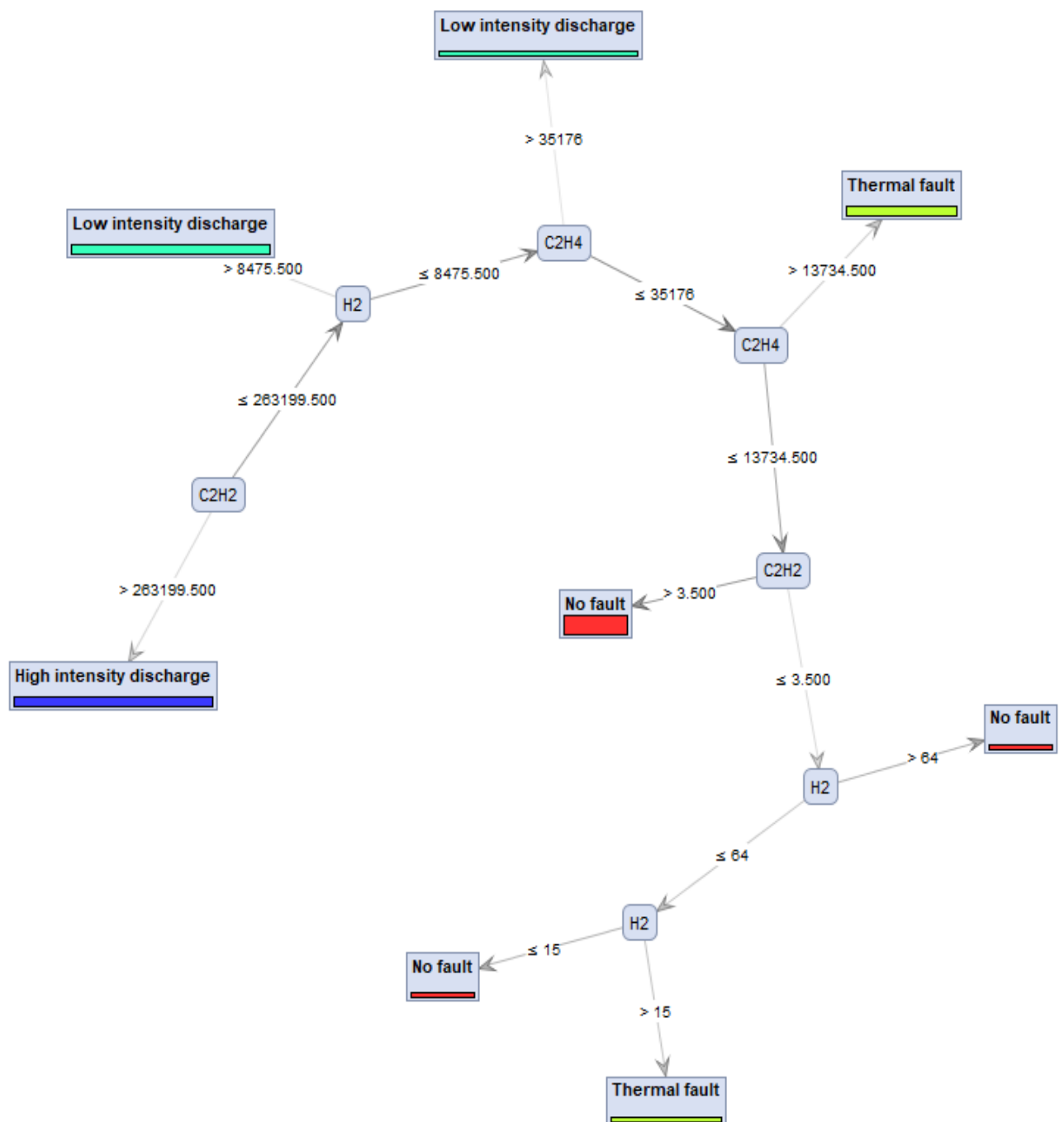
Hydrogen Oxygen Nitrogen Methane CO CO2 Ethylene Ethane Acetylene DBDS Power factor Interfacial V Dielectric rigidity Water content

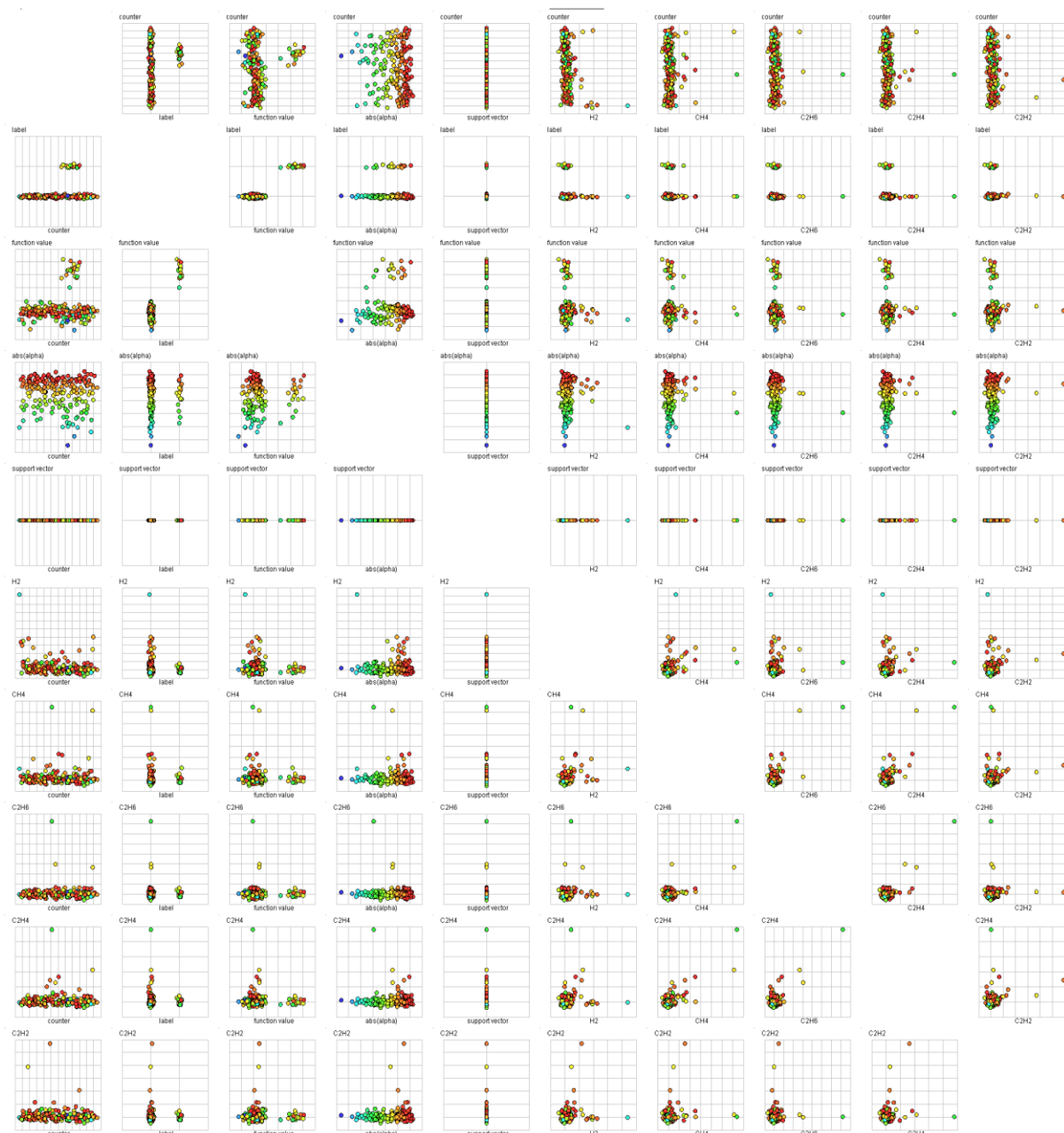


Project in Rapidminer folder contains the different developed models with optimization



Results





Tested Algorithms 6Gas-4Labels	Accuracy	Relative Error	Root Mean Squared Error	Root Relative Squared Error	Squared Error
Random Tree	89.74%	10.81%	0.381	0.302	0.101
Random forest	100.00%	4.57%	0.093	0.088	0.009
Decision stump	66.67%	47.41%	0.544	0.518	0.296
Decision tree	100.00%	0.00%	0	0	0
KNN	100.00%	0.00%	0	0	0
Neural Network	94.87%	7.02%	0.222	0.211	0.049

SVM-PSO Radial Kernel	73.75%	44.89%	0.45	1.25	0.21
SVM-PSO Multiquadric Kernel	36.88%	63.13%	0.77	2.43	0.63
SVM-PSO Epachnenikov Kernel	76.25%	47.56%	0.48	1.33	0.23
SVM-PSO Anova Kernel	97.50%	38.31%	0.39	1.09	0.15
SVM-Evolutionary Radial Kernel	83.13%	45.13%	0.46	1.25	0.21
SVM-Evolutionary Multiquadric Kernel	23.75%	76.25%	0.87	2.57	0.76
SVM-Evolutionary Epachnenikov Kernel	78.13%	46.99%	0.47	1.31	0.23
SVM-Evolutionary Anova Kernel	97.50%	37.57%	0.38	1.06	0.15

Tested Algorithms 5GAS-7Labels	Accuracy	Relative Error	Root Mean Squared Error	Root Relative Squared Error	Squared Error
Random Tree	43.90%	67.82%	0.701	0.471	0.492
Random forest	48.78%	66.62%	0.699	0.47	0.489
Decision stump	29.27%	78.86%	0.803	0.54	0.644
Decision tree	46.43%	62.84%	0.715	0.481	0.512
KNN	53.66%	56.34%	0.681	0.458	0.463
K-Grid-Optimized-KNN	70.73%	55.74%	0.588	0.395	0.346
K-Grid-Optimized-Random Forest	73.17%	63.56%	0.65	0.437	0.423
SVM-PSO Radial Kernel	85.71%	37.12%	0.39	0.9	0.15
SVM-PSO Multiquadric Kernel	21.67%	78.33%	0.88	2.21	0.73
SVM-PSO Epachnenikov Kernel	75.24%	50.00%	0.5	1.22	0.25
SVM-PSO Anova Kernel	69.29%	46.34%	0.48	1.14	0.22
SVM-Evolutionary Radial Kernel	85.95%	48.20%	0.48	1.17	0.23
SVM-Evolutionary Multiquadric Kernel	28.81%	71.19%	0.84	2.11	0.71
SVM-Evolutionary Epachnenikov Kernel	85.71%	48.53%	0.49	1.18	0.24
SVM-Evolutionary Anova Kernel	85.48%	44.51%	0.45	1.09	0.2

Tested Algorithms 6Gas-4Labels	Accuracy	Relative Error	Root Mean Squared Error	Root Relative Squared Error	Squared Error
Random Tree	89.74%	10.81%	0.381	0.302	0.101

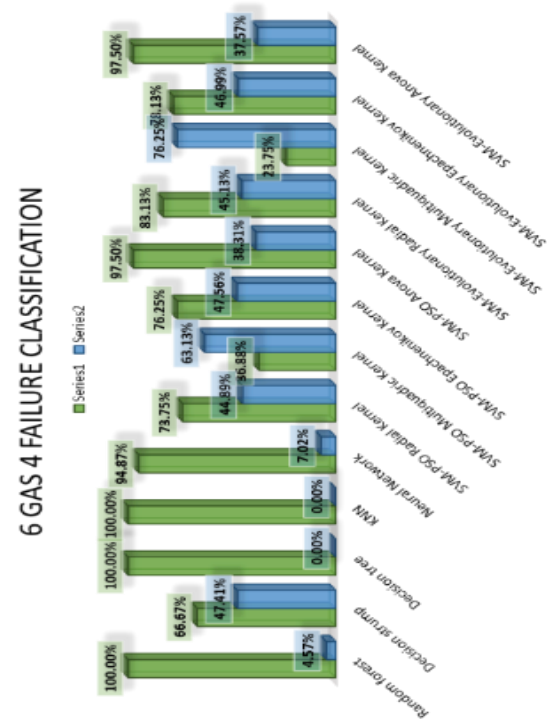
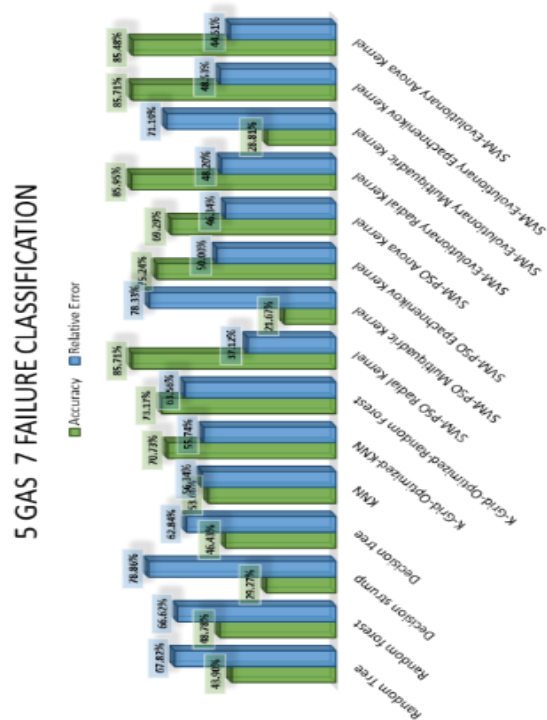
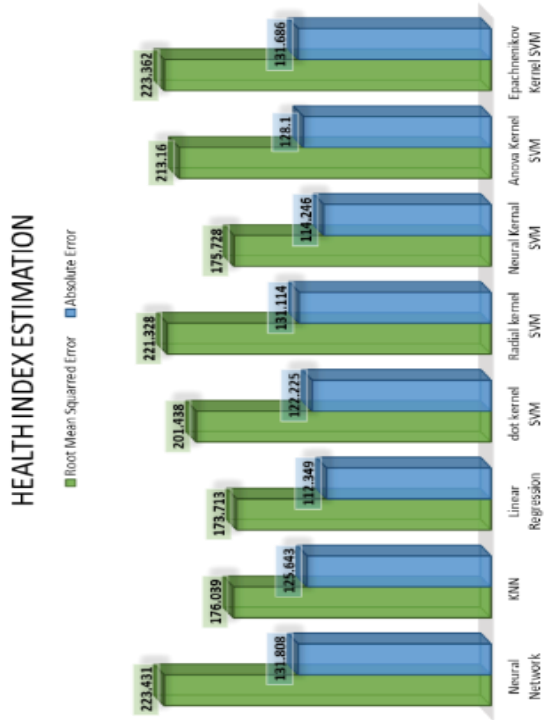
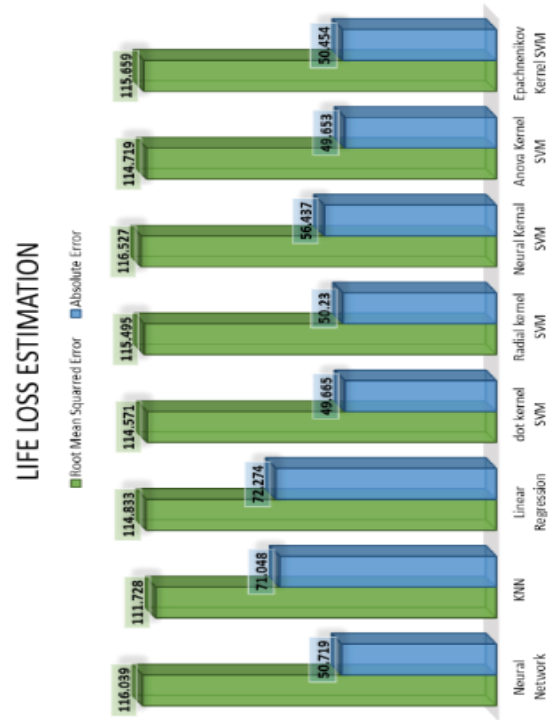
Random forest	100.00%	4.57%	0.093	0.088	0.009
Decision stump	66.67%	47.41%	0.544	0.518	0.296
Decision tree	100.00%	0.00%	0	0	0
KNN	100.00%	0.00%	0	0	0
Neural Network	94.87%	7.02%	0.222	0.211	0.049
SVM-PSO Radial Kernel	73.75%	44.89%	0.45	1.25	0.21
SVM-PSO Multiquadric Kernel	36.88%	63.13%	0.77	2.43	0.63
SVM-PSO Epachnenikov Kernel	76.25%	47.56%	0.48	1.33	0.23
SVM-PSO Anova Kernel	97.50%	38.31%	0.39	1.09	0.15
SVM-Evolutionary Radial Kernel	83.13%	45.13%	0.46	1.25	0.21
SVM-Evolutionary Multiquadric Kernel	23.75%	76.25%	0.87	2.57	0.76
SVM-Evolutionary Epachnenikov Kernel	78.13%	46.99%	0.47	1.31	0.23
SVM-Evolutionary Anova Kernel	97.50%	37.57%	0.38	1.06	0.15

Tested Algorithms Life Loss	Root Mean Squared Error	Absolute Error	Normalized Absolute Error	Squared Error
Neural Network	116.039	50.719	0.737	13465.07
KNN	111.728	71.048	1.033	12483.2
Linear Regression	114.833	72.274	1.05	13186.68
dot kernel SVM	114.571	49.665	0.722	13126.6
Radial kernel SVM	115.495	50.23	0.73	13339.08
Neural Kernal SVM	116.527	56.437	0.82	13578.48
Anova Kernel SVM	114.719	49.653	0.722	13160.44
Epachnenikov Kernel SVM	115.659	50.454	0.733	13376.93

Tested Algorithms Health Index	Root Mean Squared Error	Absolute Error	Normalized Absolute Error	Squared Error
Neural Network	223.431	131.808	0.863	49921.43
KNN	176.039	125.643	0.822	30989.86
Linear Regression	173.713	112.349	0.735	30176.4
dot kernel SVM	201.438	122.225	0.8	40577.39
Radial kernel SVM	221.328	131.114	0.858	48986.25

Neural Kernal SVM	175.728	114.246	0.748	30880.36
Anova Kernel SVM	213.16	128.1	0.838	45437.39
Epachnenikov Kernel SVM	223.362	131.686	0.862	49890.74

A comparative study of the results



The Developed Monitoring Platform for Power Transformers using (Thingsboard)

