

# Generic Self-Evolving TSK Fuzzy Neural Network with Rough Set (GSETSK+RS)

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## Project Motivation

Fuzzy neural networks are the hybrid of artificial neural networks and the fuzzy systems. They have the learning ability of neural network and the human-like reasoning ability of fuzzy system. Generic self-evolving TSK fuzzy neural network (GSETSK) is a type of fuzzy neural network based on the Takagi-Sugeno-Kang (TSK) inference system. Though it tackles the existing problems of TSK model, it is **unable to maintain a compact and interpretable rule base when dealing with large dimensional problems**. The proposed solution is to **implement a rough-set based attribute reduction** in GSETSK.

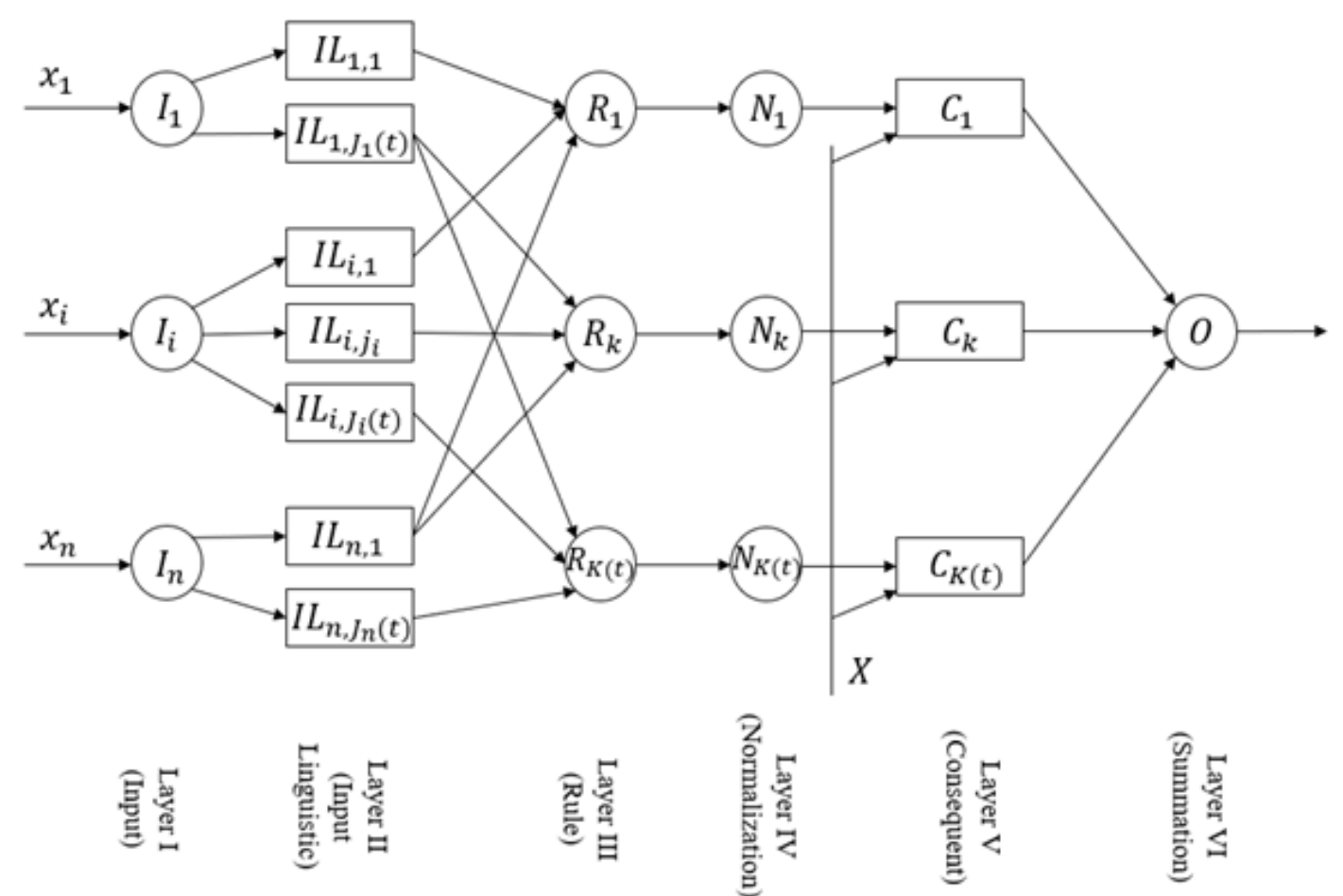
## Overview of GSETSK+RS

GSETSK+RS adopts the six-layer structure and the learning process of GSETSK. Rough-set based attribute reduction is applied at the end of the training to remove irrelevant or insignificant attributes.

### Rough Set

An attribute is considered to be insignificant if

- 1 Removing it does not result in inconsistency in the rule base
- 2 Removing it does not reduce the firing strength of any rule for any data instance



Six-layer structure of GSETSK+RS

## Experimental Results and Conclusion

### Wisconsin Breast Cancer Prediction

Model	Accuracy	Sensitivity	No. of features	No. of rules
GSETSK	96.9%	96.4%	9	52
GSETSK+RS	96.7%	96.4%	4	16

Model	Rule
GSETSK	IF $v_1$ is low AND $v_2$ is low AND $v_3$ is low AND $v_4$ is low AND $v_5$ is low AND $v_6$ is low AND $v_7$ is low AND $v_8$ is low AND $v_9$ is low THEN $f(X)$
GSETSK+RS	IF $v_1$ is low AND $v_5$ is low AND $v_6$ is low AND $v_8$ is low THEN $f(X)$

### Dow Jones Industrial Average Stock Forecast

Model	RMSE	R	No. of features	No. of rules
GSETSK	313.3	0.998	9	36
GSETSK+RS	313.8	0.999	5	19



**GSETSK+RS achieves similar performance as GSETSK with fewer features and rules. The rules in GSETSK+RS are more interpretable** because of fewer number of terms.