

## ***Abstract***

*Solar cycle prediction is difficult and important task. This prediction is difficult because it shows chaotic behaviour and has 11-years cycle approximately. Then, this prediction is important because its impact to earth like satellite, weather, telecommunication system, and electric transmission.*

*Embedding's Taken theorem is important tool to analyse chaotic system by transforming it into phase space. In phase space, chaotic system shows deterministic and unfolds hidden information. So, it makes solar cycle is easy to predict.*

*Evolving Recurrent Neural Networks (ERNN) is proposed method to find optimum Elman-RNN model by using optimization algorithm of Evolutionary Programming to predict solar cycle. In recent years, Elman-RNN has showed good result in prediction. It caused Elman-RNN can find dynamical of system through unit called context layer. On the other hand, EP is one of optimization algorithm of Evolutionary Algorithms (EAs) that its chromosome length can be different size. So, EP is good to find proper weights and proper Elman architecture.*

*The best Elman-RNN model has one neuron in hidden layer mostly. The proposed method yields NMSE for training  $2,6 \times 10^{-3}$  and testing  $6,5 \times 10^{-4}$ .*

***Keywords:*** *prediction, solar cycle, Evolutionary Programming, Elman Neural Networks, sunspot, Taken's embedding theorem, chaotic, time series.*