

Self-organizing linear output map (SOLO) - Kuo-lin Hsu, Hoshin V. Gupta, Xiaogang Gao, and Soroosh Sorooshian (not available for the meeting)

PUB-IAHS Workshop
Uncertainty Analysis in
Environmental Modelling
6th – 8th July 2004

a) Introduction:

The SOLO model is a neural network model, which consists a classification layer using self-organizing feature map and a mapping layer combined from a group of linear regressions (see Figure 1). Principal component analysis is used to transfer correlated input variables to independent components; therefore ill-condition of regression parameters from highly correlated input variables may be prevented. Uncertainty of the model estimates is also provided through the linear regression function and normal distribution of the model estimates (see Figure 2 for the uncertain bounds of a set of forecasted time series).

b) Advantages

- The method is suitable for a wide variety of hydrologic and nonhydrologic time series applications. The procedure provides rapid and inexpensive estimation of network structure/parameters and system outputs.
- The regression variables are transferred into independent variables using principle component analysis.
- Uncertainty of model predictions is calculated.
- The characteristics of SOLO that provide additional insight into the underlying functional processes, thereby extending its usefulness beyond applied forecast applications.

c) Disadvantages

- SOLO is a piece-wise linear regression model. Input regression variables should be assigned before regression analysis

d) Main Assumption

Regression residuals are assumed normal distributed.

e) Most appropriate application areas

The method is suitable for the nonlinear regression analysis of hydrological time series.

f) Reading list

Hsu, K., H.V. Gupta, X. Gao, S. Sorooshian, and B. Imam, "SOLO—An Artificial Neural Network Suitable for Hydrologic Modeling and Analysis", Water Resources Research, Vol.38, No.12. 1302, 2002.

g) Software availability

Available upon request. Contact Kuo-lin Hsu at kuoinh@uci.edu

h) Web links or other information

None Given

i) Figures

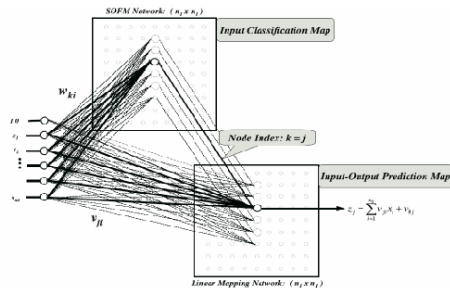


Figure 1: The architecture of a SOLO model. The SOLO network consists of three layers. The input layer includes n_0 units connecting to the input variables. The classification and mapping layers consist of $n_1 \times n_1$ matrixes. The input data are classified into $n_2 \times n_2$ clusters using a Self-Organizing Feature Map (SOFM) (Kohonen, 1989). In the mapping layer, model outputs are generated from multivariate linear regression.

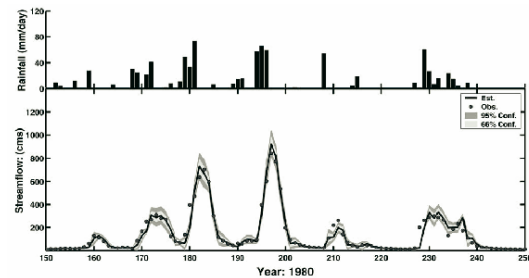


Figure 2: Observed and predicted streamflow data. Predicted confidence bounds (66% and 95%) are included.

j) Delegates Comments (please add !!)