

Accepted Manuscript

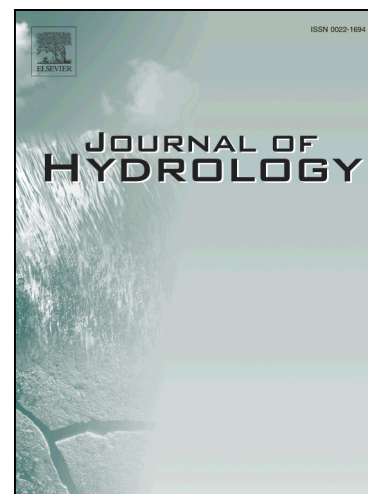
Variable complexity online sequential extreme learning machine, with applications to streamflow prediction

Aranildo R. Lima, William W. Hsieh, Alex J. Cannon

PII: S0022-1694(17)30713-8
DOI: <https://doi.org/10.1016/j.jhydrol.2017.10.037>
Reference: HYDROL 22317

To appear in: *Journal of Hydrology*

Received Date: 3 June 2017
Revised Date: 25 August 2017
Accepted Date: 19 October 2017



Please cite this article as: Lima, A.R., Hsieh, W.W., Cannon, A.J., Variable complexity online sequential extreme learning machine, with applications to streamflow prediction, *Journal of Hydrology* (2017), doi: <https://doi.org/10.1016/j.jhydrol.2017.10.037>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

1 Variable complexity online sequential extreme learning
2 machine, with applications to streamflow prediction

3 Aranildo R. Lima^a, William W. Hsieh^{*a}, Alex J. Cannon^b

4 ^a*Department of Earth, Ocean and Atmospheric Sciences, University of British Columbia, Vancouver,*
5 *BC, Canada*

6 ^b*Climate Data and Analysis Section, Climate Research Division, Environment and Climate Change*
7 *Canada, Canada.*

8 **Abstract**

In situations where new data arrive continually, online learning algorithms are computationally much less costly than batch learning ones in maintaining the model up-to-date. The extreme learning machine (ELM), a single hidden layer artificial neural network with random weights in the hidden layer, is solved by linear least squares, and has an online learning version, the online sequential ELM (OSELM). As more data become available during online learning, information on the longer time scale becomes available, so ideally the model complexity should be allowed to change, but the number of hidden nodes (HN) remains fixed in OSELM. A variable complexity VC-OSELM algorithm is proposed to dynamically add or remove HN in the OSELM, allowing the model complexity to vary automatically as online learning proceeds. The performance of VC-OSELM was compared with OSELM in daily streamflow predictions at two hydrological stations in British Columbia, Canada, with VC-OSELM significantly outperforming OSELM in mean absolute error, root mean squared error and Nash-Sutcliffe efficiency at both stations.

9 *Keywords:* streamflow, forecast, online learning, randomized neural networks, extreme
10 learning machine (ELM), online sequential ELM (OSELM)

11 **1. Introduction**

12 Artificial neural networks (ANN) have been widely studied and used in hydrology and
13 water resources (Shamseldin, 2010; Rasouli et al., 2012; Abrahart et al., 2012; Maier et al.,

^{*}Corresponding author. 4028 Hopesmore Dr., Victoria, BC V8N 5S9, Canada. Tel: 1-250-388-0508.
E-mail: whsieh@eos.ubc.ca

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات