

Accepted Manuscript

Noise-modulated Neural Networks as an Application of Stochastic Resonance

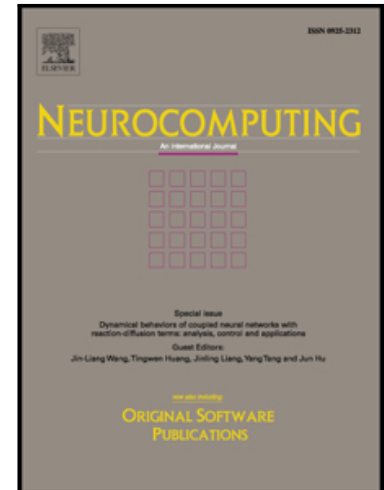
Shuhei Ikemoto, Fabio DallaLibera, Koh Hosoda

PII: S0925-2312(17)31412-1
DOI: [10.1016/j.neucom.2016.12.111](https://doi.org/10.1016/j.neucom.2016.12.111)
Reference: NEUCOM 18802

To appear in: *Neurocomputing*

Received date: 30 May 2016
Revised date: 13 December 2016
Accepted date: 26 December 2016

Please cite this article as: Shuhei Ikemoto, Fabio DallaLibera, Koh Hosoda, Noise-modulated Neural Networks as an Application of Stochastic Resonance, *Neurocomputing* (2017), doi: [10.1016/j.neucom.2016.12.111](https://doi.org/10.1016/j.neucom.2016.12.111)



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.

Noise-modulated Neural Networks as an Application of Stochastic Resonance

Shuhei Ikemoto^{a,*}, Fabio DallaLibera^a, Koh Hosoda^a

^a*Osaka University, 1-3, Machikaneyama, Toyonaka, Osaka, Japan*

Abstract

Stochastic resonance (SR) is a phenomenon by which the input signal of a nonlinear system, with magnitude too small to affect the output, becomes observable by adding a non-zero level of noise to the system. SR is known to assist biological beings in coping with noisy environments, providing sophisticated information processing and adaptive behaviors. The SR effect can be interpreted as a decrease in the input-output information loss of a nonlinear system by making it stochastically closer to a linear system. This work shows how SR can improve the performance of a system even when the desired input-output relationship is nonlinear, specifically for the case of a neural networks whose hidden layers consist of threshold functions. Universal approximation capability of neural networks exploiting SR is then discussed: although a network consisting of threshold activation functions has been proven to be an universal approximator in the context of the extreme learning machine (ELM), once SR is taken into account, the system can be deemed as a classic three-layer neural network whose universality has been previously proven by simpler proofs. After proving the universal approximation capability for an infinite number of hidden units, the performance achieved with a finite number of hidden units is evaluated using two training algorithms, namely backpropagation and ELM. Results highlight the SR effect occurring in the proposed system, and the relationship among the

*Corresponding author

Email addresses: ikemoto@sys.es.osaka-u.ac.jp (Shuhei Ikemoto),
fabiodl@gmail.com (Fabio DallaLibera), hosoda@sys.es.osaka-u.ac.jp (Koh Hosoda)

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