

# Yongmiao Hong, Oliver Linton, Jiajing Sun, and Meiting Zhu's contribution to the Discussion of "the Discussion Meeting on Probabilistic and statistical aspects of machine learning"

Hong, Yongmiao; Linton, Oliver; Sun, Jiajing; Zhu, Meiting

DOI:  
[10.1093/jrsssb/qkad152](https://doi.org/10.1093/jrsssb/qkad152)

License:  
Creative Commons: Attribution-NonCommercial (CC BY-NC)

*Document Version*  
Peer reviewed version

*Citation for published version (Harvard):*  
Hong, Y, Linton, O, Sun, J & Zhu, M 2023, 'Yongmiao Hong, Oliver Linton, Jiajing Sun, and Meiting Zhu's contribution to the Discussion of "the Discussion Meeting on Probabilistic and statistical aspects of machine learning"', *Royal Statistical Society. Journal. Series B: Statistical Methodology*.  
<https://doi.org/10.1093/jrsssb/qkad152>

[Link to publication on Research at Birmingham portal](#)

## General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

## Take down policy

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact [UBIRA@lists.bham.ac.uk](mailto:UBIRA@lists.bham.ac.uk) providing details and we will remove access to the work immediately and investigate.

# Yongmiao Hong, Oliver Linton, Jiajing Sun, and Meiting Zhu's contribution to the Discussion of 'the Discussion Meeting on Probabilistic and statistical aspects of machine learning'

Yongmiao Hong<sup>†</sup>, Oliver Linton<sup>‡</sup>, Jiajing Sun<sup>§</sup>, & Meiting Zhu<sup>¶</sup>

Academy of Mathematics and Systems Science, Chinese Academy of Sciences<sup>†</sup>

Faculty of Economics, University of Cambridge<sup>‡</sup>

School of Mathematics, University of Birmingham<sup>§</sup>

School of Economics, Xiamen University<sup>¶</sup>

This paper proposes a neural network-based approach for automating offline change-point detection. The authors show that CUSUM and generalized CUSUM are a special case of their neural network class. They emphasize misclassification error rates and their theoretical contribution is to establish some elegant results for these under i.i.d. unit variance Gaussian data with a possible change in mean. Their theoretical results outline the conditions on the ERM neural network that allow it to achieve comparable performance to the classic CUSUM test for this very specific setting. The framework relies on  $N$  training data samples that are independent and identical copies where  $N \gg n^2 \log n$ , which seems like a lot of training is needed! The CUSUM test only needs the sample of size  $n$ . In many financial applications we have a single time series  $\{X_1, \dots, X_n\}$  and we are interested in when and how change-points occur throughout the whole observation period. It is not clear how or why we should divide the data into training and testing samples and some guidance on this would be appreciated. In those applications considerable care needs to be taken in how to account for time series dependence and where this is treated nonparametrically issues arise with bandwidth selection. The self-normalization method proposed by Shao (2010) does not require the choice of tuning parameter and so is also automatic, and is quite widely used for identifying change-points within a given dataset, Shao and Zhang (2010). However, this method is known to have poor power properties. Recently, Hong et al. (2022) proposed the adjusted-range based self-normalization, in-

stead of the usual long run variance normalization, and this appears to work better under some long memory alternatives.

The current paper avoids the normalization issue altogether by making use of training data, and perhaps where that exists their method can have advantages, but it would be interesting to know how competitive their method is on financial time series and on realistic sampling schemes with longer range dependence.

## References

- [1] Hong, Y., O. B. Linton, B. McCabe, J. Sun, & S. Wang (2023). Kolmogorov-smirnov type testing for structural breaks: A new adjusted-range based self-normalization approach. To appear in *Journal of Econometrics*. Available at SSRN 3850894.
- [2] Shao, X. (2010). A self-normalized approach to confidence interval construction in time series. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)*, 72(3), 343–366.
- [3] Shao, X., & Zhang, X. (2010). Testing for change points in time series. *Journal of the American Statistical Association*, 105(491), 1228–1240.