Learning-based change point detection for robust and accurate nuclear counting

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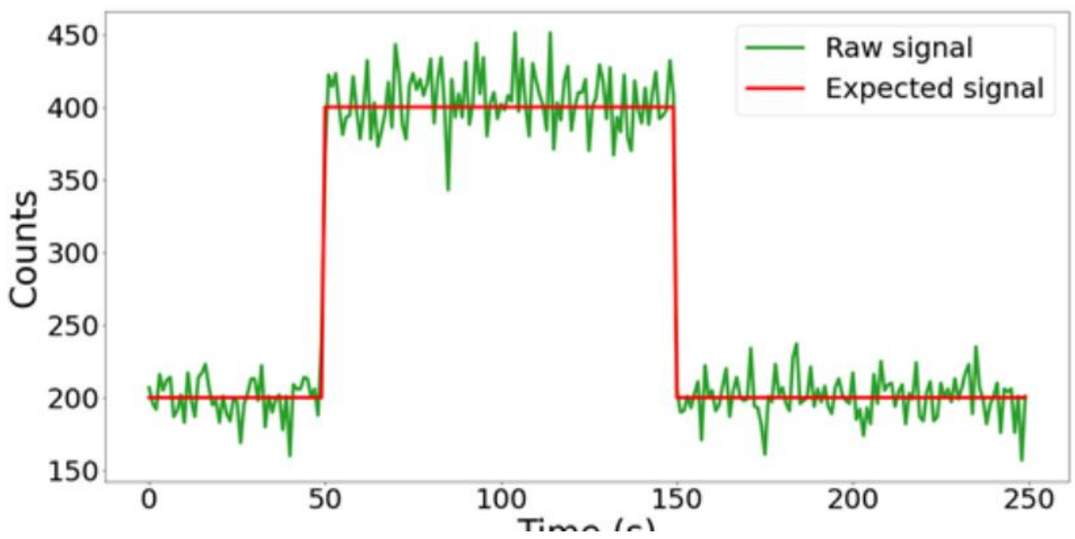
Introduction

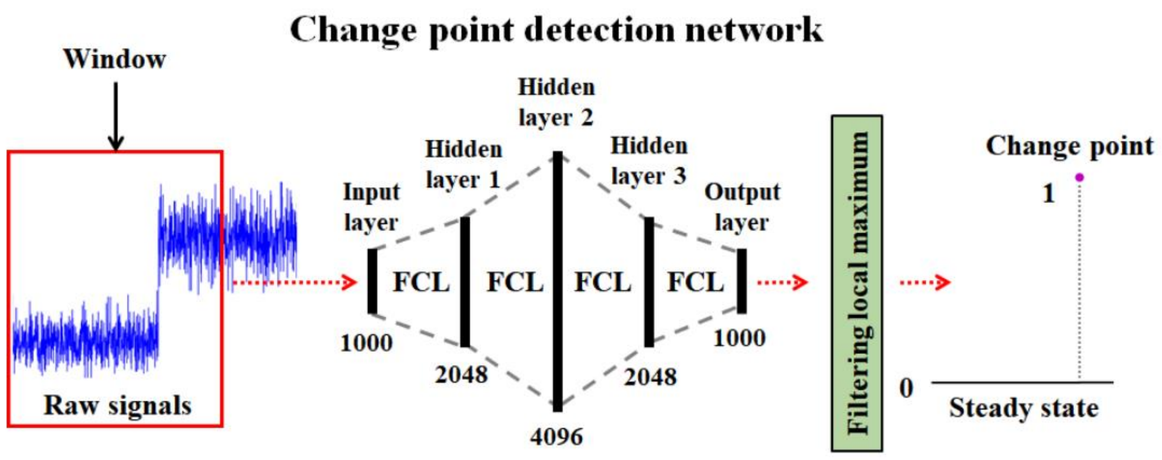
- Change point detection in adaptive filtering approaches is highly important to achieve great performances for nuclear counting process.
- However, it represents poor performances for various of scenarios, leading to limited usages for radiation monitoring
- This research proposes a data-driven and learning-based change point detection model for robust and accurate nuclear counting



An example of nuclear counting process

Proposed Method

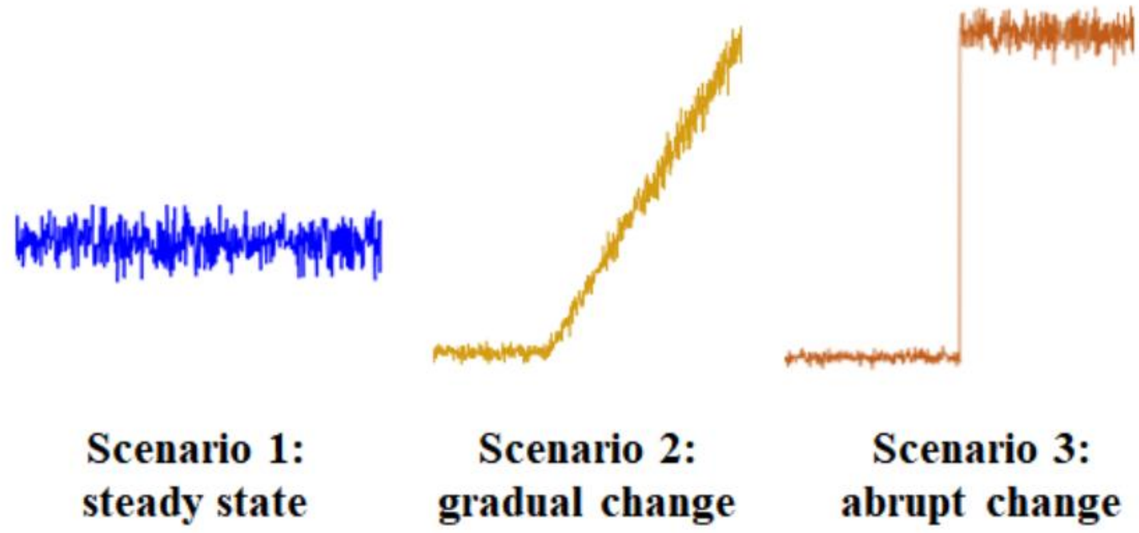
- The change point detection model is a convolutional neural network and its training scheme is inspired by multi-label classification task.
- The model takes raw signals and then generates a change status of each time point.



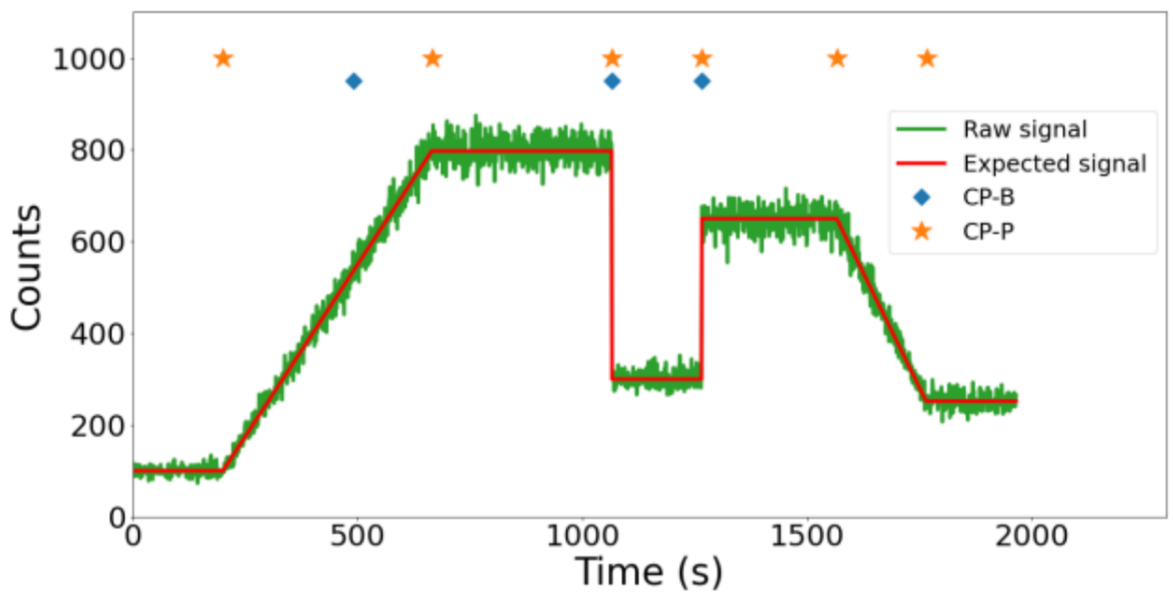
$$L = -\sum\sum \hat{y}_i^k log\hat{y}_i^k + (1-\hat{y}_i^k)\log(1-\hat{y}_i^k)$$

The overall framework of the learning-based change point detection method

Experimental Results



Training dataset of nuclear counting



Results of change point detection

Evaluation metrics	Baseline method	Proposed method
Accuracy	65.61%	96.83%
Precision	57.24%	95.95%

Quantitative performances evaluations

Conclusion

- This paper presents the learning-based change point detection method for boosting adaptive smoothing filters.
- The proposed method greatly improves the accuracy and precision of change point detection, both quantitatively and qualitatively.
- In the future, the performance will be evaluated for the actual nuclear dataset.