实验室交流周报告

——第九周

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时　间：2018.05.06

本周工作

1. 小论文投出；《Generative Adversarial Networks for Noise Reduction in Electrocardiogram》

2. 查阅资料；
   - 《Time Series Segmentation through Automatic Feature Learning》

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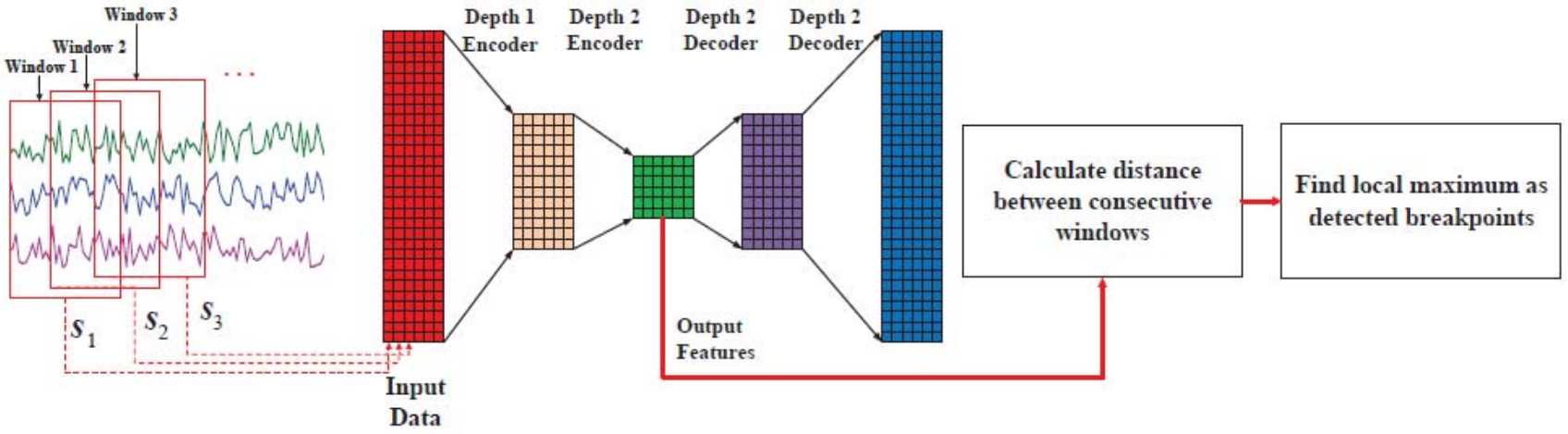
《Time Series Segmentation through Automatic Feature Learning》

- 概述：利用Auto-Encoder网络对IoT时序数据进行changepoint 检测；
- 文章贡献
  ① 提出了一种新方法：利用深度学习自动提取时间序列数据中的有用特征；
  ② 在真实IoT时序数据上验证了方法的有效性；
  ③ 与其他方法对比，取得了最好的实验结果；

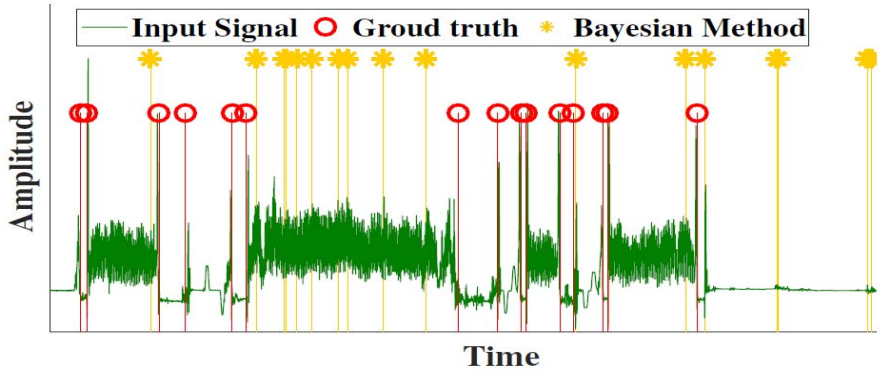
实验方法

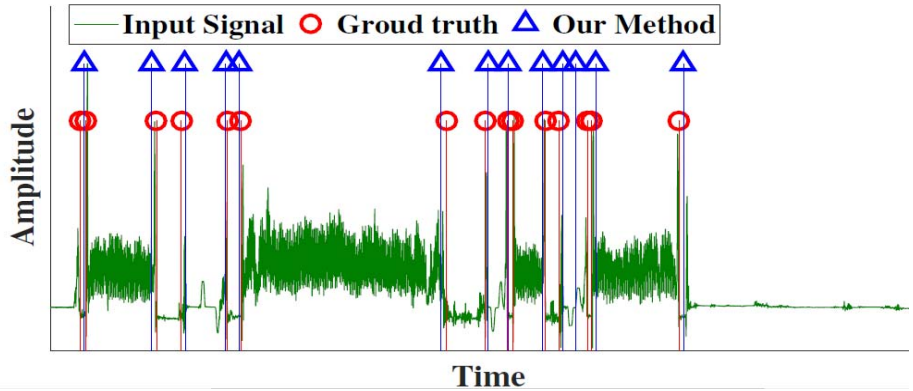
- 自编码器Auto-Encoder
  - ① 多传感器数据数据；
  - ② 连续时间窗滑动；
  - ③ 训练网络，得到编码之后的特征feature；
  - ④ 计算连续时间窗编码后的特征之间的距离；
  - ⑤ 得到changepoint。

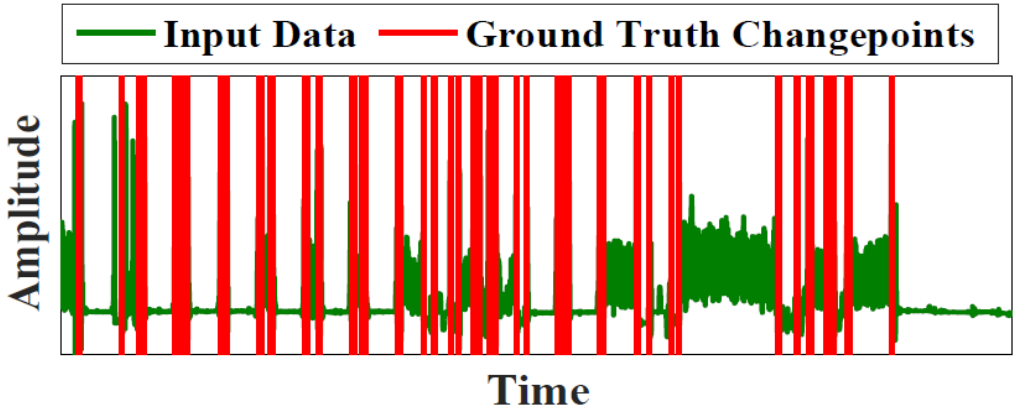


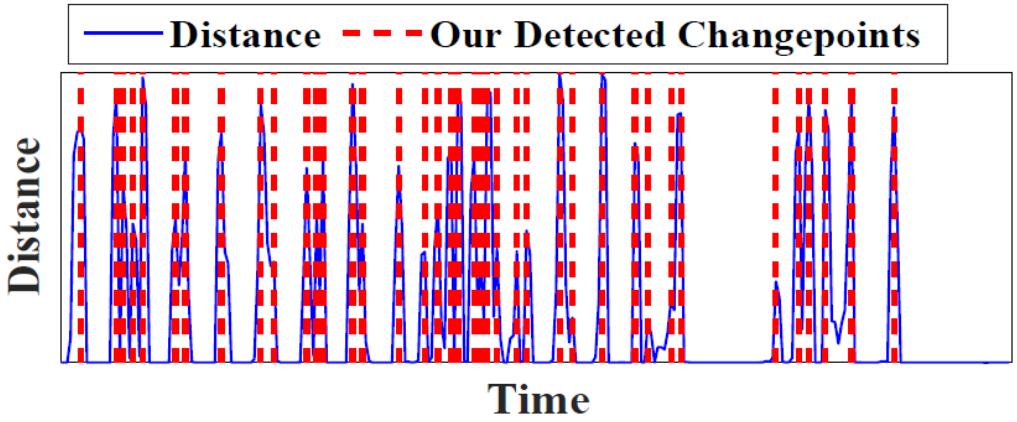
实验结果

- 实验数据集：
  - ① the Crowdsignal.io sensor data set
  - ② an EEG eye state data set [37]
  - ③ the UCI human activity recognition data set
  - ④ and the DCASE2016 sound data set









总结

- 基于深度学习，提出了一种新的changepoint检测方法；
- 分析了传统方法的不足；
- 将算法应用于真实IoT数据；

- 文章书写值得学习——在现有方法上的改进。

Algorithm 1 Our Deep Learning Based Breakpoint Detection Approach.

Input: The input data $\{s_t\}_{t=1}^{T/N_w}$, α is the learning rate;
Output: The set of detected breakpoints $\mathbb{C}$;

/*****Optimize W, b_e, b_d, W' for Feature Extraction*****/

1. Initialize W, b_e, b_d randomly and set the tied weights $W' = W^T$ according to [21, 28, 42];
   Initialize the set of breakpoints as $\mathbb{C} = \emptyset$;
2. **For each iteration** $= 1, 2, 3 \cdots$ **do**
3. Set $\Delta W = 0, \Delta b_e = 0, \Delta b_d = 0, \Delta W' = 0$;
4. Compute the partial derivatives with respect to W, b_e, b_d, W' as

$$\begin{aligned} \Delta W &= \frac{\partial J(W, b_e, b_d, W')}{\partial W} \\ \Delta b_e &= \frac{\partial J(W, b_e, b_d, W')}{\partial b_e} \\ \Delta b_d &= \frac{\partial J(W, b_e, b_d, W')}{\partial b_d} \\ \Delta W' &= \frac{\partial J(W, b_e, b_d, W')}{\partial W'} \end{aligned} \tag{8}$$

5. Update W, b_e, b_d, W' by gradient descent as

$$\begin{aligned} W &:= W - \alpha \Delta W \\ b_e &:= b_e - \alpha \Delta b_e \\ b_d &:= b_d - \alpha \Delta b_d \\ W' &:= W' - \alpha \Delta W' \end{aligned} \tag{9}$$

/****************** Breakpoint Detection ******************/

6. **For each segmented time window** s_t **do**
7. Extract features f_t according to Eq. 1;
8. Compute distances $Dist_t$ between consecutive feature vectors according to Eq. 10;
9. **If** $Dist_t$ **is a *local-maximal distance* do**
10. Classify t as a breakpoint, i.e., $\mathbb{C} \leftarrow \mathbb{C} \cup t$;

欢迎批评指正

谢谢大家！