Dynamic Interpretable Change Point Detection for Physiological Data Analysis

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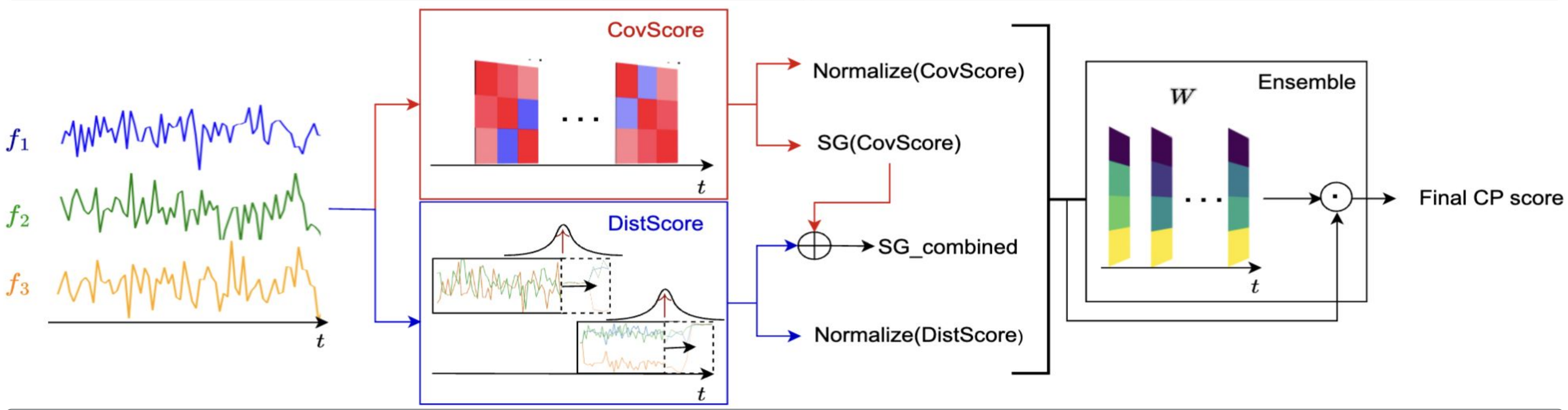
OBJECTIVES

- Detect change points in multivariate time series, identifying shifts in both distribution and feature correlation
- Interpret magnitude and direction of change
- Increase generalization ability
- Enhance decision-making in healthcare, e.g. activity recognition and delivery time detection during pregnancy

DATASETS

- Simulated Data
  - Jumping Mean, Changing Variance, Changing Correlation, Arbitrary CPs
- Human Activity Recognition (HAR)
- Better Understanding of Metamorphosis of Pregnancy Study
- Bee Dance

METHOD - Time Varying Change Point Detection (TiVaCPD)



CASE STUDY

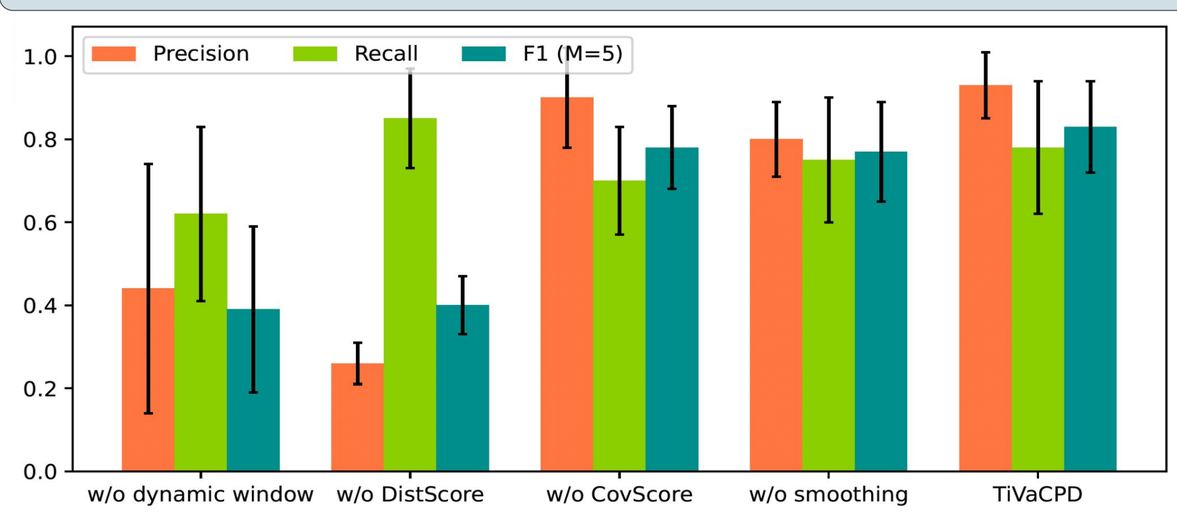
An example of CPD for a subject in the *Better Understanding of the Metamorphosis of Pregnancy* study.

RESULTS

Method	Precision	Recall	F1(M=5)
KL-CPD	0.66 (0.11)	0.20 (0.03)	0.30 (0.04)
Roerich	0.69 (0.15)	0.11 (0.03)	0.18 (0.05)
GraphTime	0.04 (0.00)	0.96 (0.02)	0.08 (0.01)
TIRE	0.52 (0.19)	0.14 (0.05)	0.22 (0.08)
TiVaCPD	0.72 (0.06)	0.48 (0.06)	**0.58 (0.06)**

Benchmarking evaluation (M=5) on the Human Activity Recognition (HAR) dataset.

ABLATION STUDY



SUMMARY

- Evaluated TiVaCPD's performance using simulated and real-world data
  - Outperforms state-of-the-art methods.
- Demonstrated TiVaCPD's application in a pregnancy case study, highlighting its effectiveness in detecting delivery time and analyzing changes in physiological signals through an interpretable heatmap.
- Future Direction:
  - Extend TiVaCPD to the online setting for real-time measurements
  - Incorporate techniques for handling missing data by leveraging correlated features and temporal dynamics.

PAPER CODE