Motivations: Trends in Real-World Applications

System Monitoring

Trend:
Abnormal sensor signals

Health Care

Trend:
Irregular heart rate

Stock Market

Trend:
Monotonous price

Financial Fraud

Trend:
Circular check kite

Gas Detection

Trend:
Gas Content

E-commerce

Trend:
Items bought together

Problem Definition

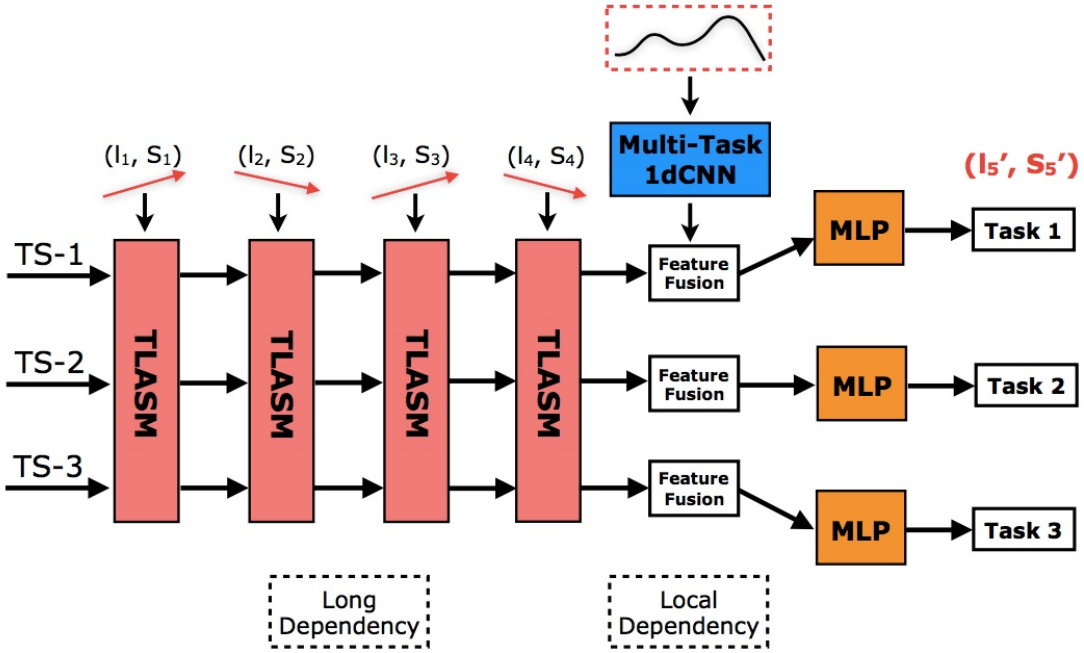
- Input: Multivariate time series
- Output:
  - Trends detected in training set
  - Trends predicted in testing set

Output: $(I_1, S_1), (I_2, S_2), \ldots, (I_n, S_n) \rightarrow (I_{n+1}, S_{n+1})$
where $I_k > \mu$, $|S_k| > \theta$

Challenges

- Trends are various
- Temporal patterns of time series are complex
- Data contain noisy
- Trends are multi-granularity

Proposed Model: DeepTrends



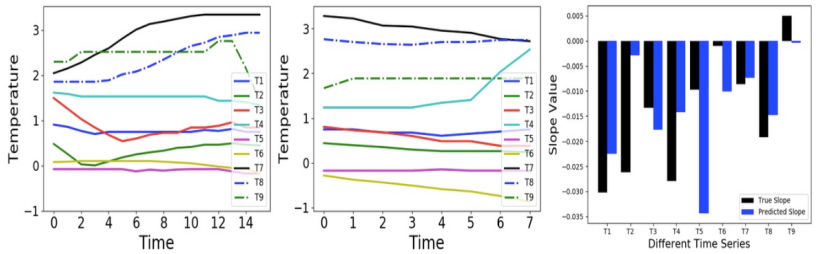
Technical Highlight of DeepTrends

- A multi-task deep model, considering both long- and short-term dependency
- The first one jointly models the temporal patterns and achieves flexible parameter sharing

Datasets

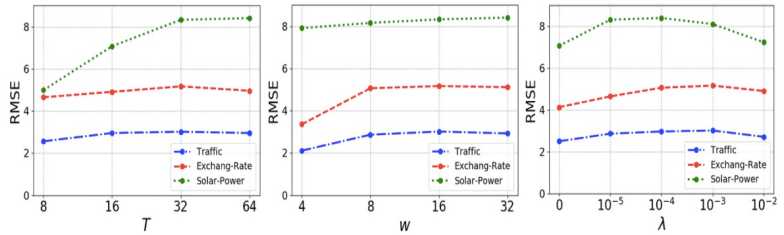
Dataset	Traffic			Exchange-Rate			Solar-Power		
μ	10	40	100	2	6	20	400	600	800
# Trends	5187	3755	1499	2312	1508	925	13957	8554	4856
# Time Steps	17544			7588			52560		
# Time Series	9			7			9		

Experimental Results



(a) Local data (b) Future data (c) True slope v.s. Predicted slope

Visualization of the trend slope prediction on the Traffic dataset



(a) Varying T (b) Varying w (c) Varying λ

Parameter sensitivity study