Predicting Quality Web Services

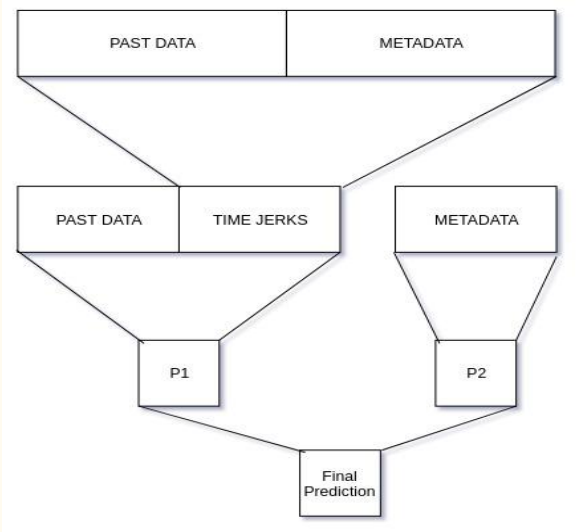
DATASET

WS-Dream Dataset : Time aware Web service QoS dataset

- This dataset describes real-world QoS measurements from 142 users on 4,500 Web services over 64 consecutive time slices (at 15-minute interval).
- Typical Record Structure
  - User ID | Service ID | Time Slice ID | Response Time (sec)
  - User ID | Service ID | Time Slice ID | Throughput (kbps)

Modelling ARIMA as Deep Nets

- The network uses dropout with 0.7 keep probability.
- Early stopping is utilized to identify the number of epochs required.
- Relu activation is used for intermediate layers, with He weight initialization.
- Least error obtained: 37.05%

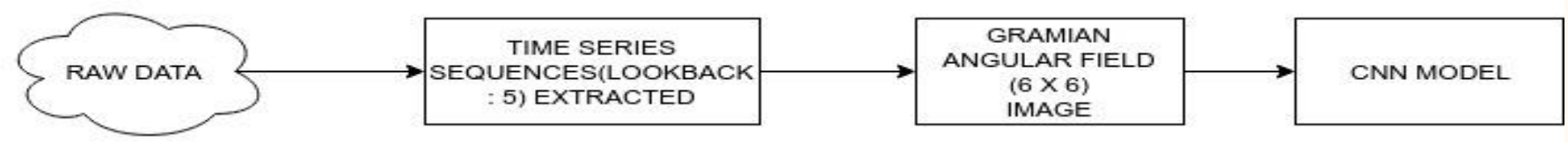



```
alpha@alpha:~/Work/web-service-response-time-forecast/DNN$ python main.py -i
Reading Data
Done
(20278515, 11) (20278515, 1) (5069629, 11) (5069629, 1)
Starting
Training the model
2018-11-27 14:51:12.314281: I tensorflow/core/platform/cpu_feature_guard.cc:14
2018-11-27 14:51:12.373810: I tensorflow/core/common_runtime/process_util.cc:0
Initial validation Error:  9.624574
Validation error after 5 epochs is: 3.6505508
Validation error after 10 epochs is: 3.4706032
Validation error after 15 epochs is: 3.3660123
Validation error after 20 epochs is: 3.2921474
Validation error after 25 epochs is: 3.2452219
Validation error after 30 epochs is: 3.2098126
Validation error after 35 epochs is: 3.185361
Validation error after 40 epochs is: 3.1625443
Validation error after 45 epochs is: 3.147944
Validation error after 50 epochs is: 3.1260529
Validation error after 55 epochs is: 3.1237903
Validation error after 60 epochs is: 3.1133533
Validation error after 65 epochs is: 3.0980124
Validation error after 70 epochs is: 3.104397
Validation error after 75 epochs is: 3.0973778
Validation error after 80 epochs is: 3.0883682
Validation error after 85 epochs is: 3.084509
Validation error after 90 epochs is: 3.0782788
Validation error after 95 epochs is: 3.0771983
Validation error after 100 epochs is: 3.0779676
Validation error after 105 epochs is: 3.077253
Validation error after 110 epochs is: 3.073517
Validation error after 115 epochs is: 3.062374
Validation error after 120 epochs is: 3.071819
Validation error after 125 epochs is: 3.0706317
Validation error after 130 epochs is: 3.0597463
Validation error after 135 epochs is: 3.068478
Validation error after 140 epochs is: 3.064022
Validation error after 145 epochs is: 3.0604553
Validation error after 150 epochs is: 3.0653281
Validation error after 155 epochs is: 3.0478957
Validation error after 160 epochs is: 3.0590272
Validation error after 165 epochs is: 3.053015
Validation error after 170 epochs is: 3.065355
Validation error after 175 epochs is: 3.070313
Validation error after 180 epochs is: 3.0580513
Validation error after 185 epochs is: 3.0588624
Validation error after 190 epochs is: 3.0539155
Validation error after 195 epochs is: 3.0512528
Validation error after 200 epochs is: 3.0593114
Test error is: 37.05032322098185%
```

Exploiting CNN

Workflow

- Feature Vector for time T
  $< RT_{t-1}\ RT_{t-2}\ RT_{t-3}\ RT_{t-4}\ RT_{t-5}\ TH_T >$
  Here RT is response time andTH is throughput



System Pipeline

Evaluation & Result

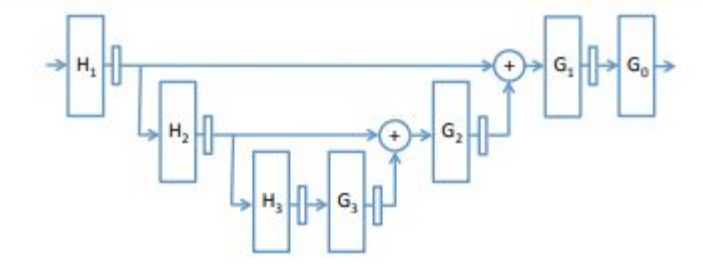
- To parse the regression problem into a classification problem, based on the distribution of the dataset response time value are segregated into 5 buckets based on their percentile value.

I	II	III	IV	V
1.126	0.439	0.255	0.091	

- Classification Accuracy **57.14 %** was obtained on the subset of dataset where lookback of 5 and throughput of the target timestamp is taken as exogenous data.

Next Steps

- Implementing the study “Time-series modeling with undecimated fully convolutional neural networks”



- Use Hidden Conditional Random Field on top of CNN model to make the whole pipeline personalised for a particular web-service.