First Demonstration of Machine-Learning-based Self-Optimizing Optical Networks (SOON) Running on Commercial Equipment

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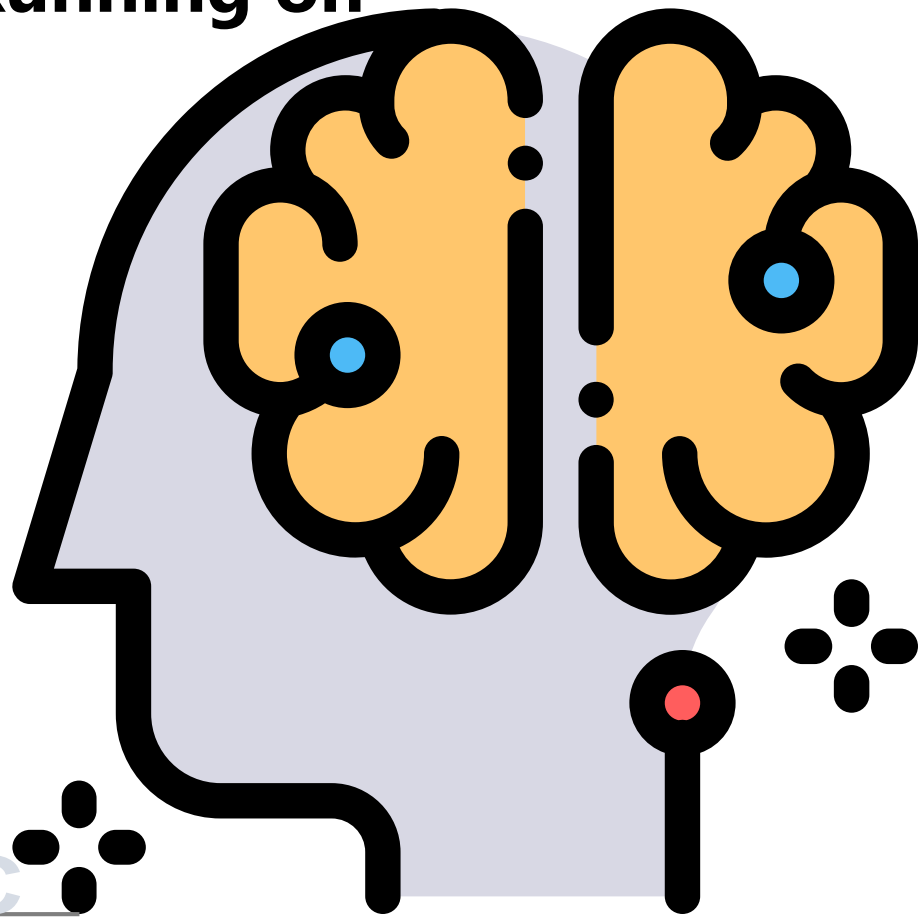


CONTENTS

01. Introduction

- Artificial Intelligence
- Applications of AI in Optical Networks

02. Implementation

- Architecture of SOON
- State Machine of Model Management
- Three application demos of SOON

03. Platform Show

- Field Experimentation
- Background of SOON

Artificial Intelligence

人工智能技术能够在复杂的环境中提取重要特征信息，并做出最优决策。

Benefit from convolutional neural network (CNN), recurrent neural network (RNN) and other powerful algorithms, AI has been applied in many fields to make the world better!

Intelligent Healthcare

Enlitic, Intuitive, Sirgical, BGI

Intelligent Assistant

Amazon Echo, Google Home, Microsoft Xiaona

Intelligent Security

SenseTime, Face ++, Hikvision

Personalized Tutoring

Iflytek, Xuebaclass, Elemental Path

Automatic Driving

Uber, Tesla, Momenta

Intelligent Logistics

Alibaba, Amazon, Macy's

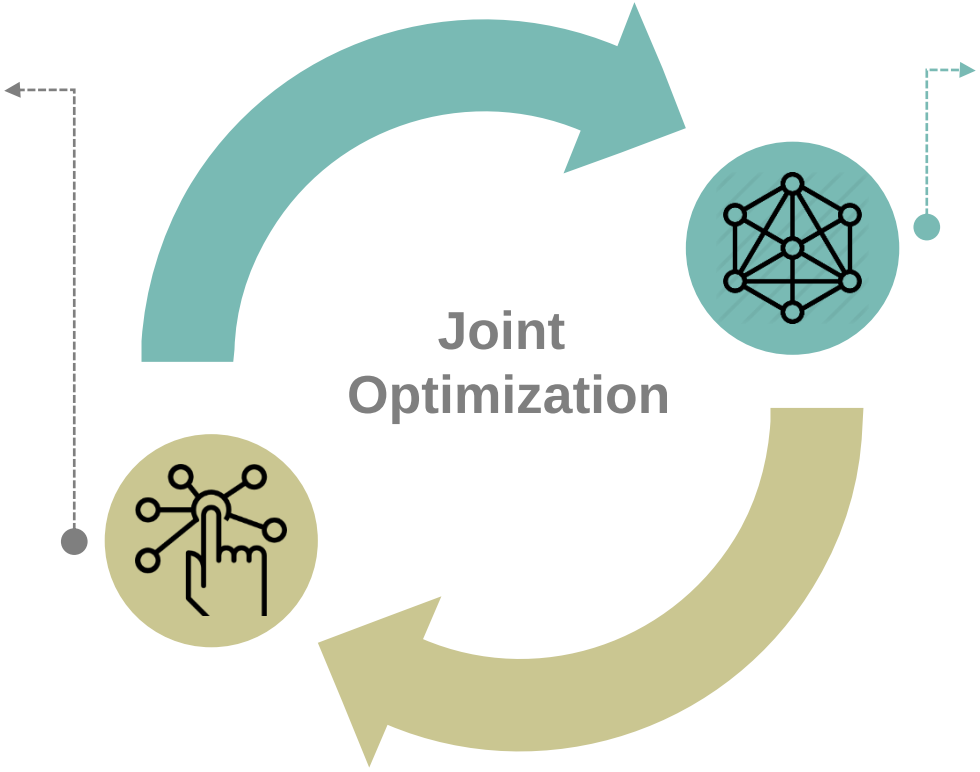
Financial Advisor

Welthfront, Kensol, Ant Financial

Applications of AI in Optical Networks

Transmission System

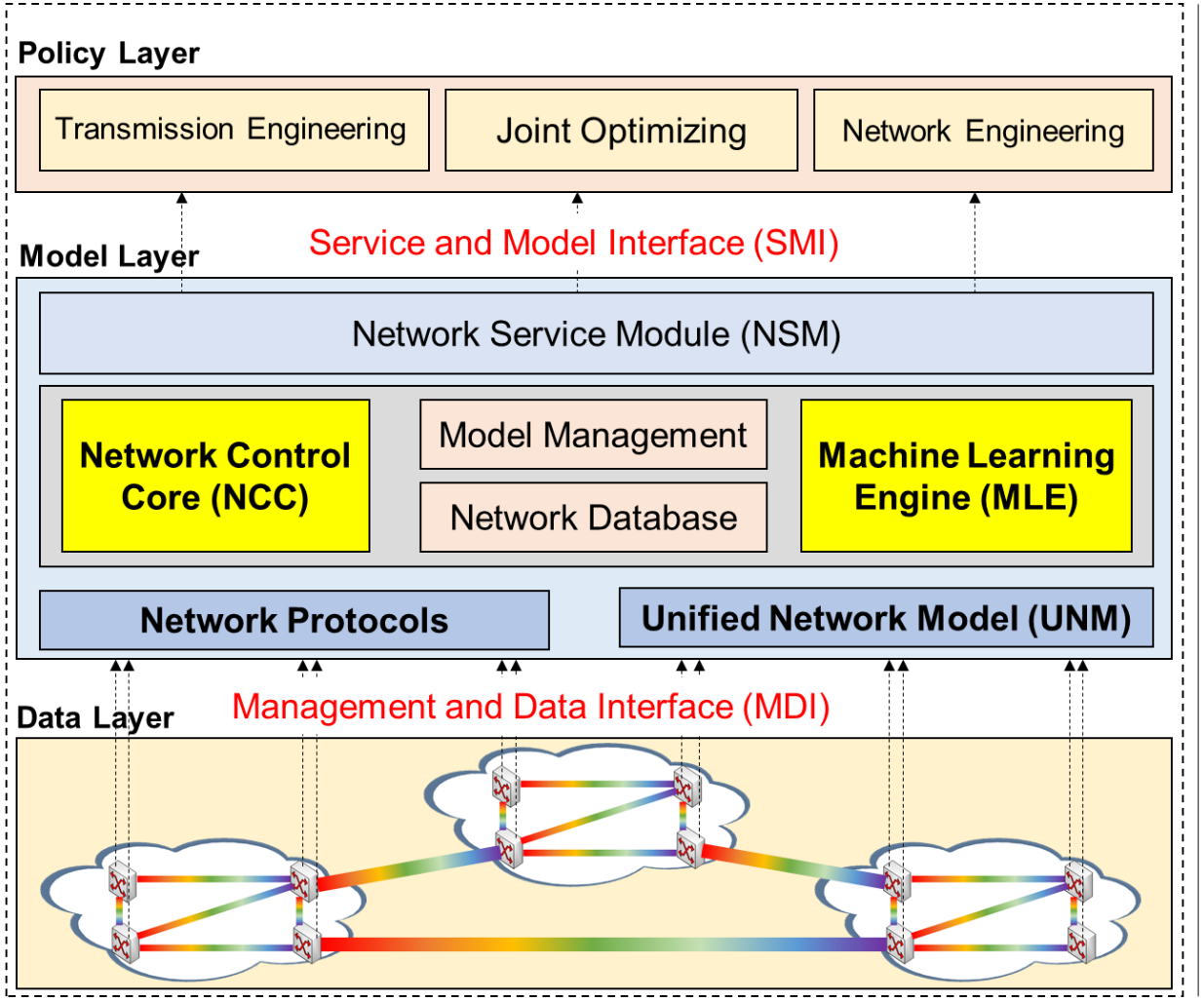
- Energy Saving
- Equipment Failure Prediction
- Modulation Format Selection
- QoT Prediction
- …

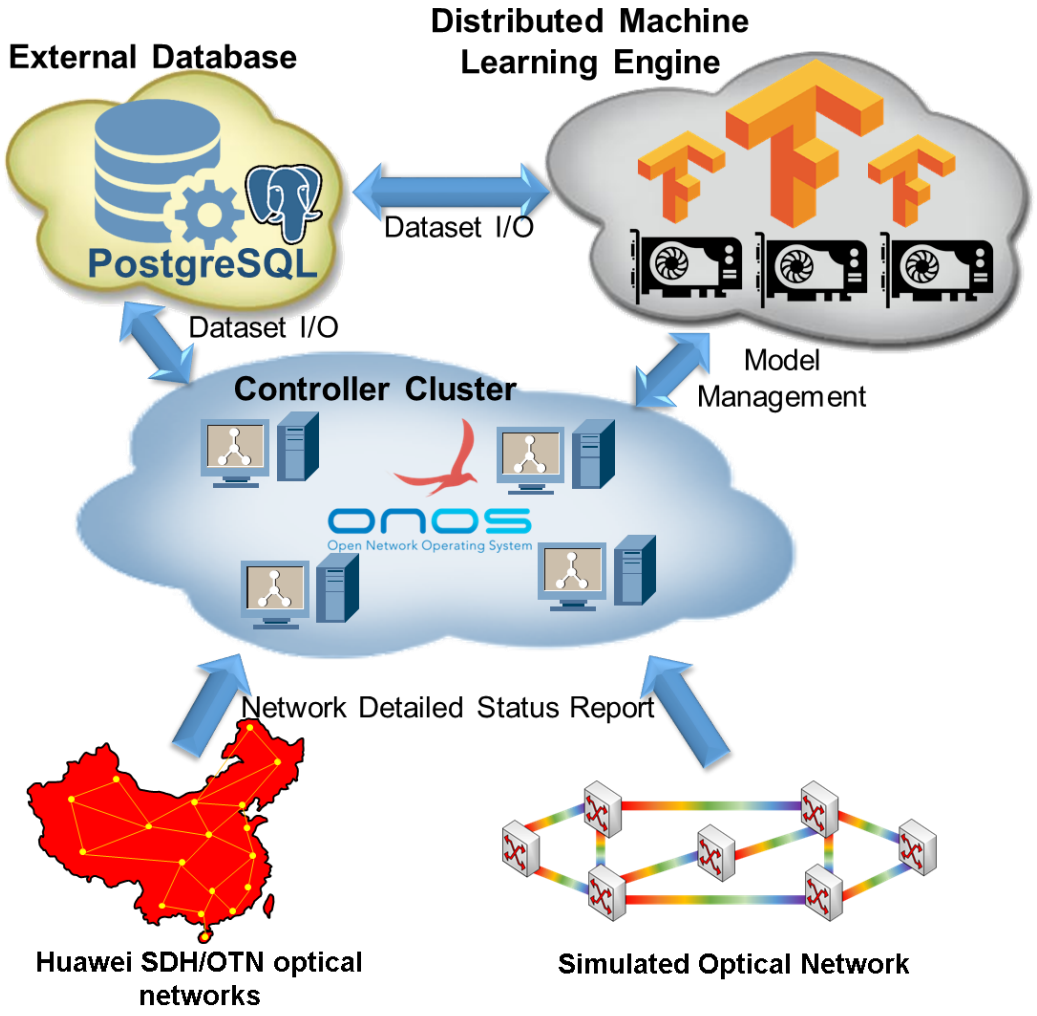


Network Management

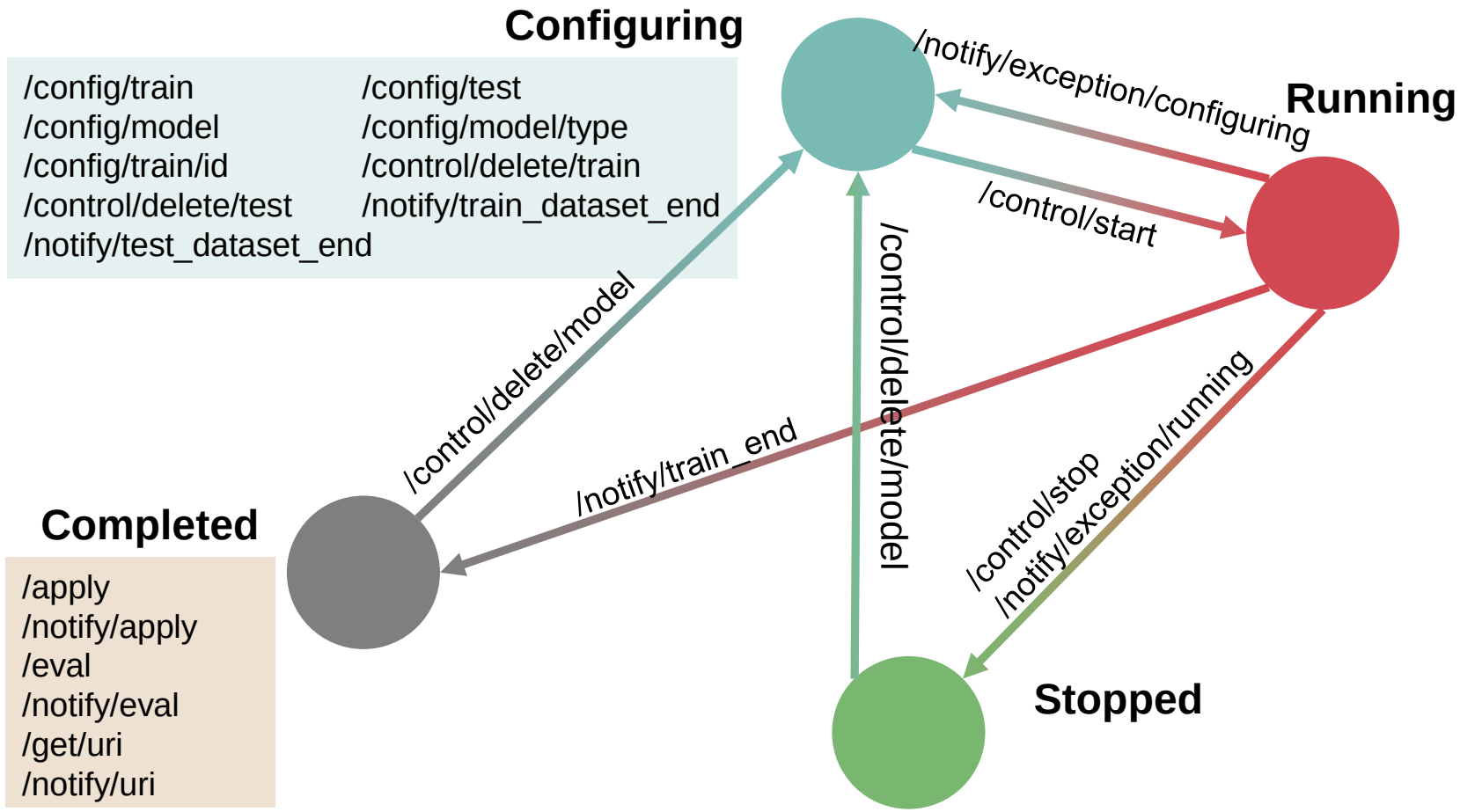
- Network Slicing
- Network Failure Location
- Resource Management
- Preparing for Special Accident
- Traffic Control
- …

Architecture of SOON





State Machine of Model Management



Demo 1 – Failure Classification

Alarm Compression

Alarms have strong correlation with others happened at same time. Alarm compression is used to extract useful information by skipping redundant alarms.

Model Training

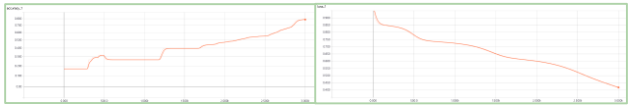
Select and configure AI algorithms to train model for fault classification.

Artificial Calibration

Fault type indicated by alarm data is calibrated by experts. Some potential patterns are hidden in these data.

Assistant Fault Location

Failure classification could help operator to locate failure.



Demo 2 – Alarm Prediction

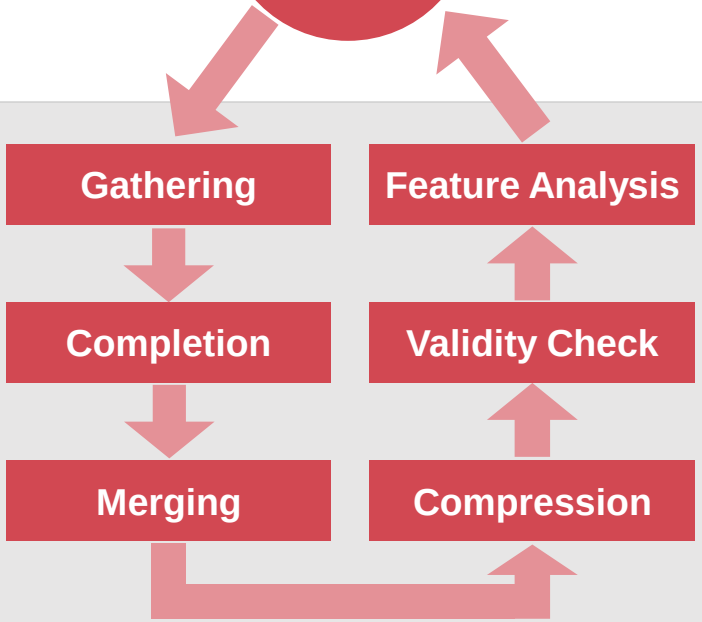
Data Collection

01 Collect history alarms and current alarms on backbone network;

02 Collect performances for all events on each optical node;

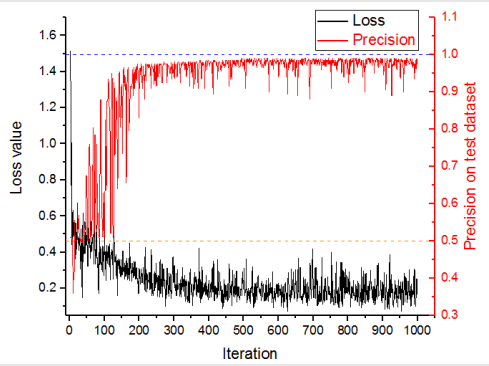
03 Adjust Collection frequency from 1/hour to 4/hour.

Data Pre-process

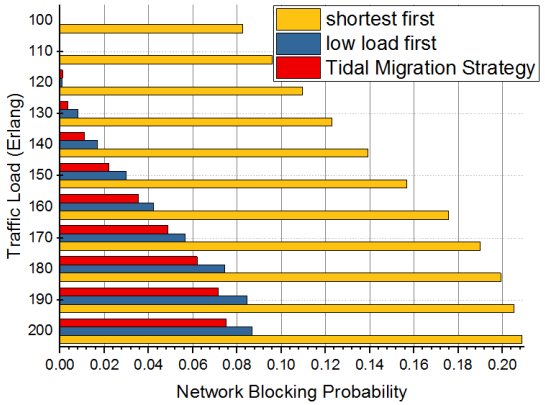


Alarm Prediction

01 Confirm predicted alarm type and predicting period;

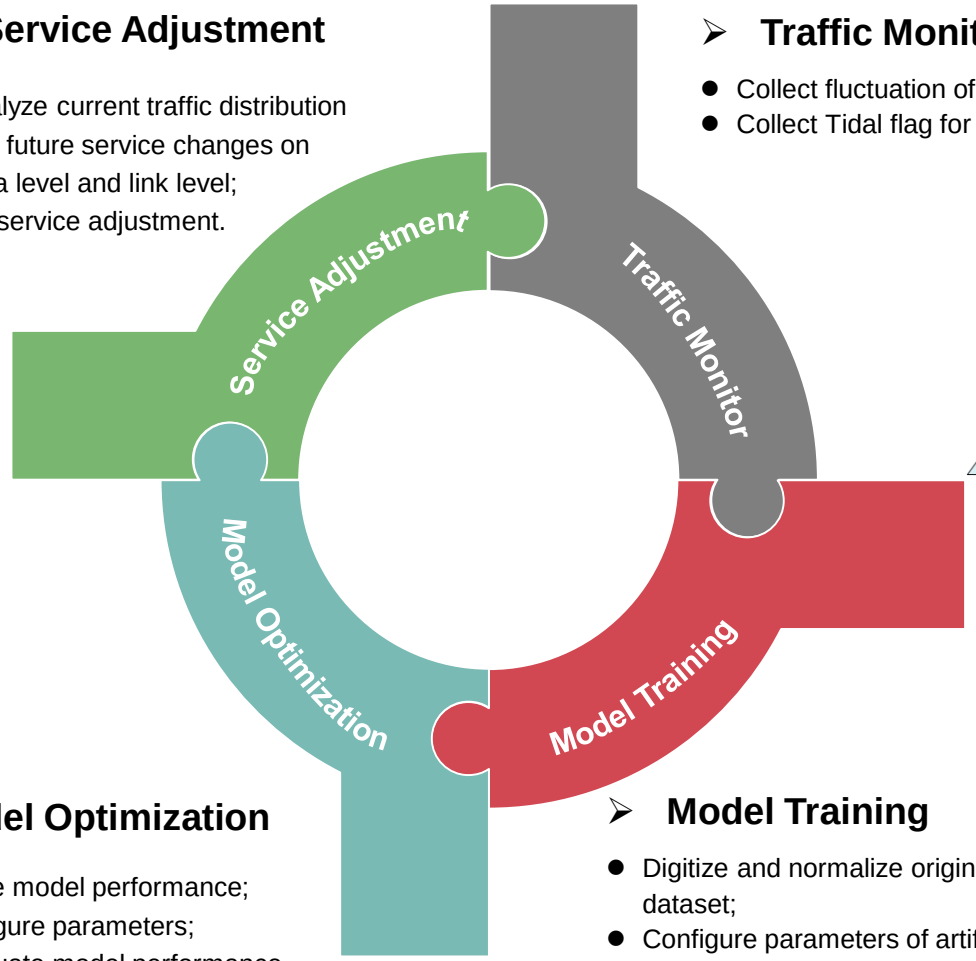


Demo 3 – Service Adjustment



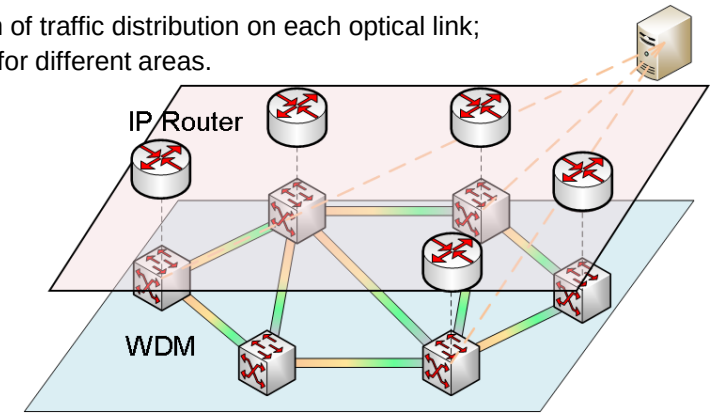
➢ Service Adjustment

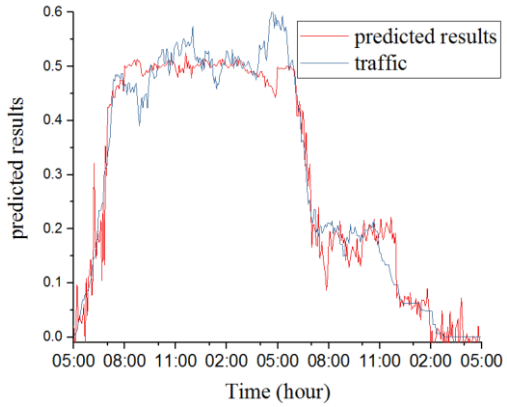
- Analyze current traffic distribution and future service changes on area level and link level;
- Do service adjustment.



➢ Traffic Monitor

- Collect fluctuation of traffic distribution on each optical link;
- Collect Tidal flag for different areas.



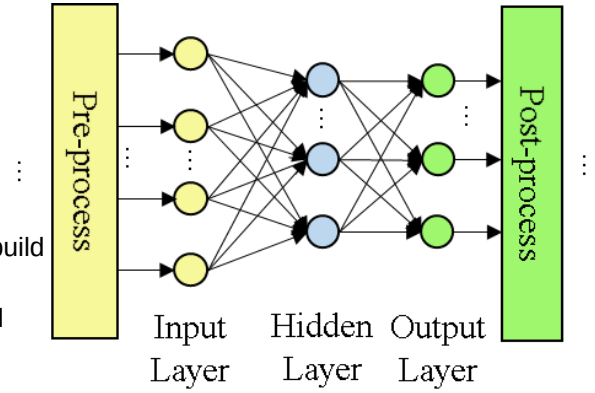


➢ Model Optimization

- Evaluate model performance;
- Reconfigure parameters;
- Re-evaluate model performance

➢ Model Training

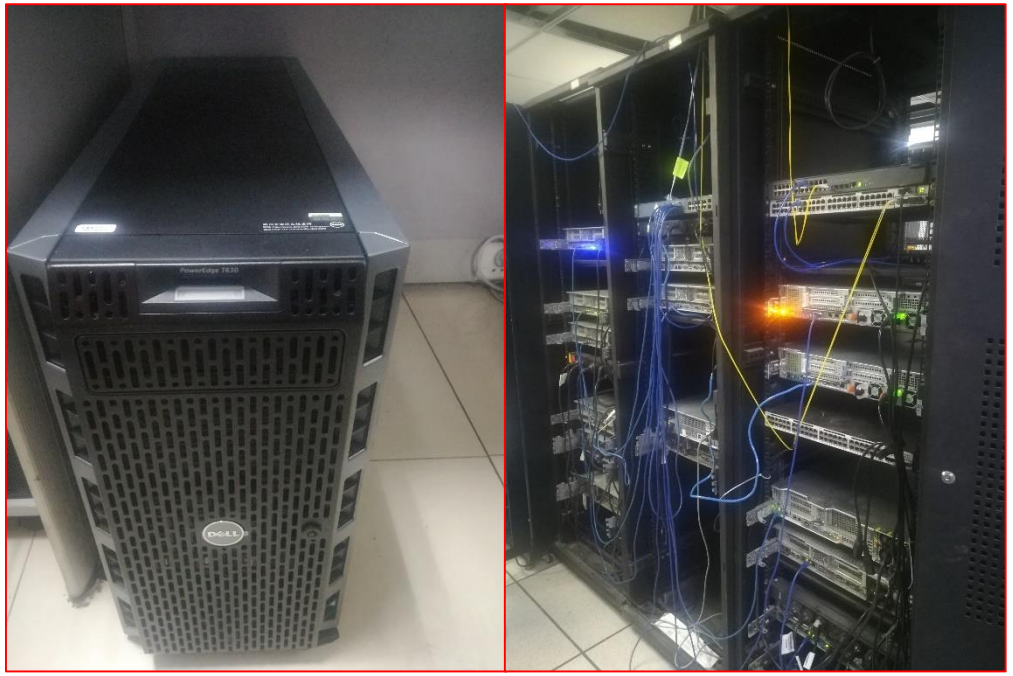
- Digitize and normalize original data to build dataset;
- Configure parameters of artificial neural network;
- Train model.



Field Experimentation

Telecommunication room

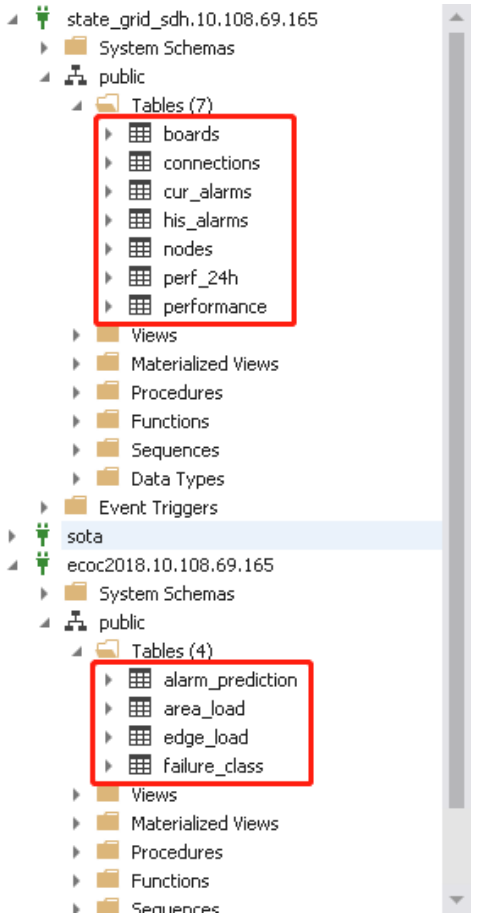
Huawei Optical telecommunication equipment are shown in State Grid Information & Telecommunication Branch.



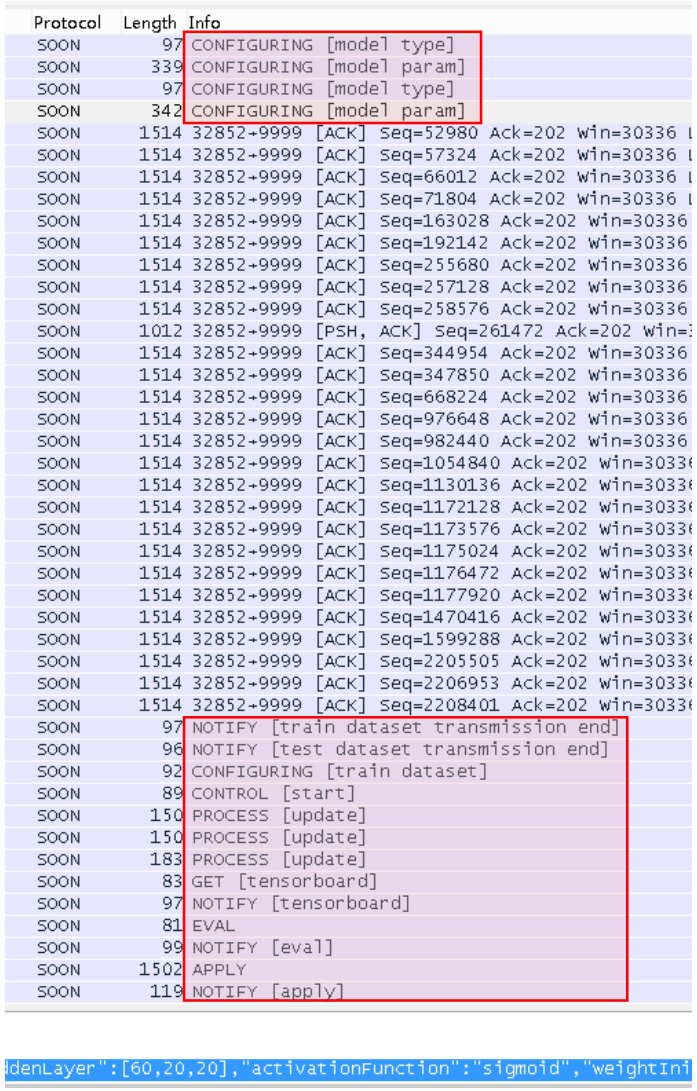
SOON Server

SOON needs GPU server to training Machine-Learning-based models, and high-performance server to run database and network controller.

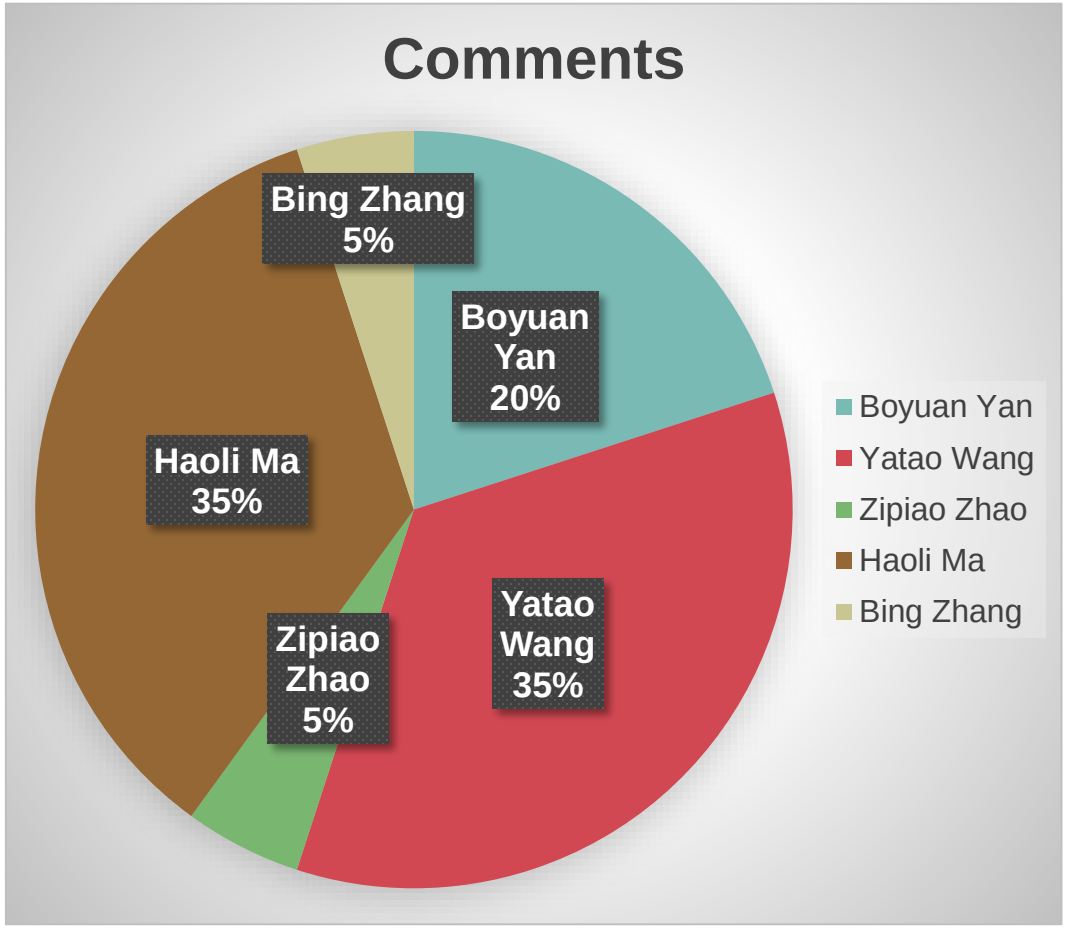
Background of SOON



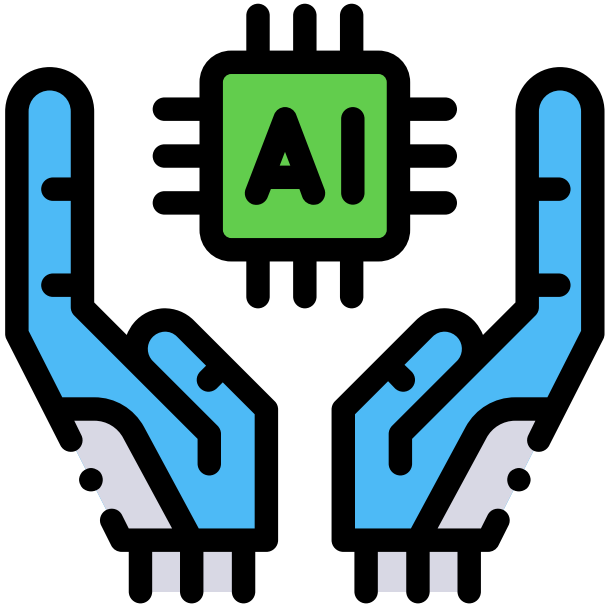
Database



Protocol of MLE



Committed Comments



A computer would deserve to be called intelligent if it could deceive a human into believing that it was human.

——Alan Turing

Beijing University of Posts and Telecommunications

https://ipoc.bupt.edu.cn/info/1034/1030.htm