Deep Learning based Optical Network Layer Recovery Mechanism for Critical Services of Power Communication Network

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INTRODUCTION

The power grid plays a vital role in serving daily life and promoting national economic development. At present, the research on fault of power communication network is mainly in the stage of fault model establishment and fault prediction. Nevertheless, in the actual power communication network, fault prediction and modeling cannot completely avoid the influence of power communication network fault on the power system, and the cost of critical services is very high. Therefore, to ensure the successful transmission of critical services, it is necessary to carry out the service recovery after the failure of the power communication network.

In this paper, based on the fault prediction and fault model of power communication network, the fault network topology pool is established, and the service resource reallocation of optical network based on deep learning is used to complete the recovery of critical services after fault.

GENERATION OF FAULT NETWORK TOPOLOGY POOL

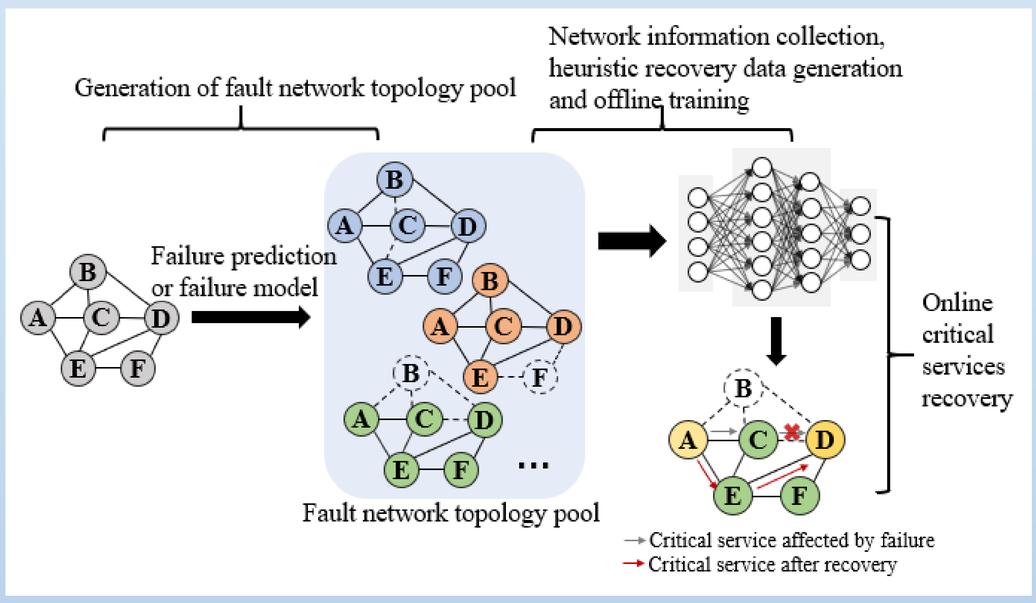

Figure 1. Deep learning based critical service recovery mechanism

OPTICAL NETWORK LAYER RECOVERY FOR CRITICAL SERVICES

Heuristic Recovery Stage (Offline)

- Path generation
- Spectrum Resource Calculation
- Resource reallocation.

Data Set Establishment and Sample Labelling Stage

- Arrange all candidate paths and frequency slot
- Represent the category of the recovery scheme using a real number

Neural Network Training and Critical Service Recovery

- Transformed into a multi classification task
- Selected from the fault network topology pool
- Restored the affected critical service

SIMULATION PARAMETERS AND RESULTS ANALYSIS

Test Conditions:

- 100000 samples in the dataset,
- 80% as training set
- 20% as test set.

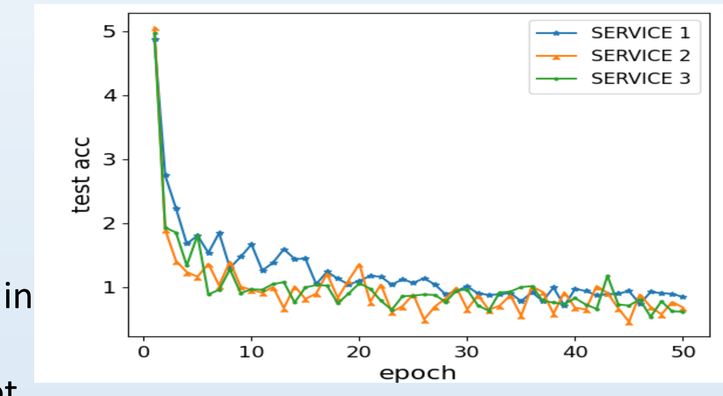

Figure 2. DNN loss function vs training process

Evaluation Results:

- Reach more than 90% accuracy
- Model loss can be reduced to a low level.

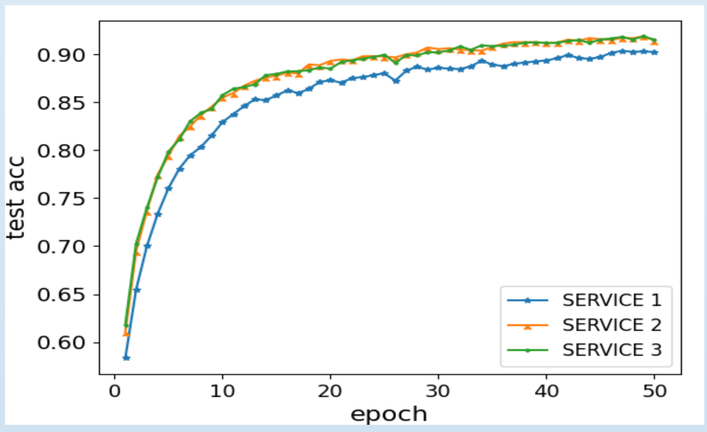

Figure 3. Model accuracy evaluation

CONCLUSION

This paper uses fault model and fault prediction to create a fault network topology pool. For each fault network topology, heuristic algorithm is used to generate data sets offline, and the optical network layer recovery problem of critical services is transformed into a classification problem and achieve the recovery based on deep learning technology. Simulation results show that the recovery success rate can reach 90% or more in the example scenario.

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