CHEDDAR

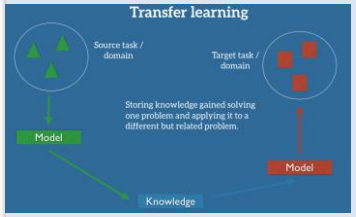
SPRINT LAB
SMART PERVASIVE CONNECTIVITY LAB

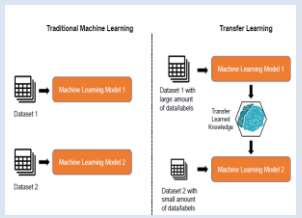
UNIVERSITY OF LEEDS

Deep Transfer Learning: A Smarter Approach to Wireless Communication

Introduction

- Transfer learning aims to leverage the learned knowledge from a resource-rich domain/task to help learning a task with not sufficient training data.
- The resource-rich domain is known as the source and the low-resource task is known as the target.
- Transfer learning works the best if the model features learned from the source task are general.





Key points:

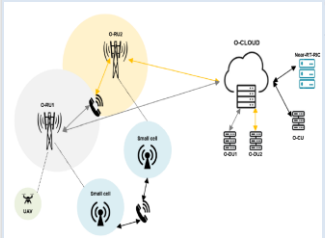
a) What to Transfer
b) When to Transfer: High task/domain similarity.
c) How to Transfer

Main issues in TL:

a) Domain mismatch
b) Overfitting: poor generalization on small datasets.
c) Data and task relevance

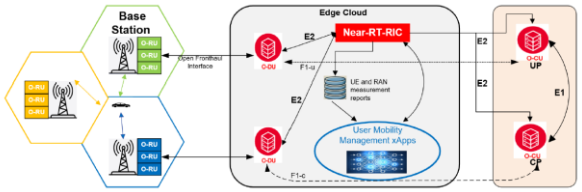
Methods

- Consider a heterogeneous dense small cell network.
- Macro (3.8 GHz) and small BSs (24 GHz) are deployed in dense urban environment.
- Dynamic UAV BSs are added into the existing network topology introduces changes that require updating the trained model to adapt to the altered configuration.



The research objective:

To demonstrate the significance of utilizing safe and accelerated deep learning with TL approaches in next-generation networks based on ORAN architecture. The aim is to adapt to new network topologies to enhance network performance.

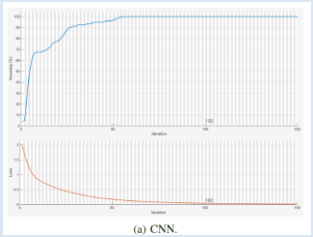


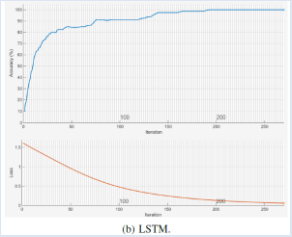
Solution:

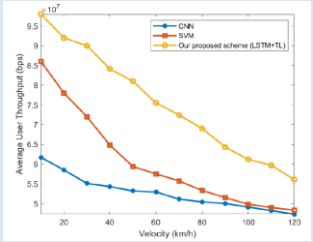
- **Step 1:** Long-Term Learning in Non-RT RIC
- **Step 2:** Near-RT RIC Layer for Real-Time Mobility Management
- **Step 3:** Handling New Environments via Transfer Learning (Pre-trained Model Utilization, Fine-Tuning, Transfer Weights)

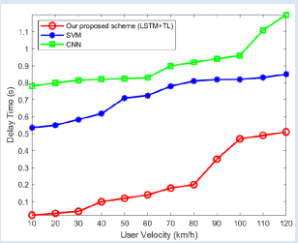
Results

- MATLAB tool
- The network performance is the average of 1000 runs
- Training Process of different DL algorithms
- Average User Throughput
- Delay time









The proposed scheme can improve the decision-making process to reduce the delay time and increase the average user throughput in the next-generation wireless communication system. Besides, the training time and computational cost can be also reduced after the transfer learning applied.

Conclusion

Investigate the transfer learning challenges in wireless communication networks

Set up a system network model

An improved user mobility decision scheme is proposed based on deep learning-based TL algorithm

The simulation results demonstrate that our proposed scheme increases the network performance in wireless networks

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