

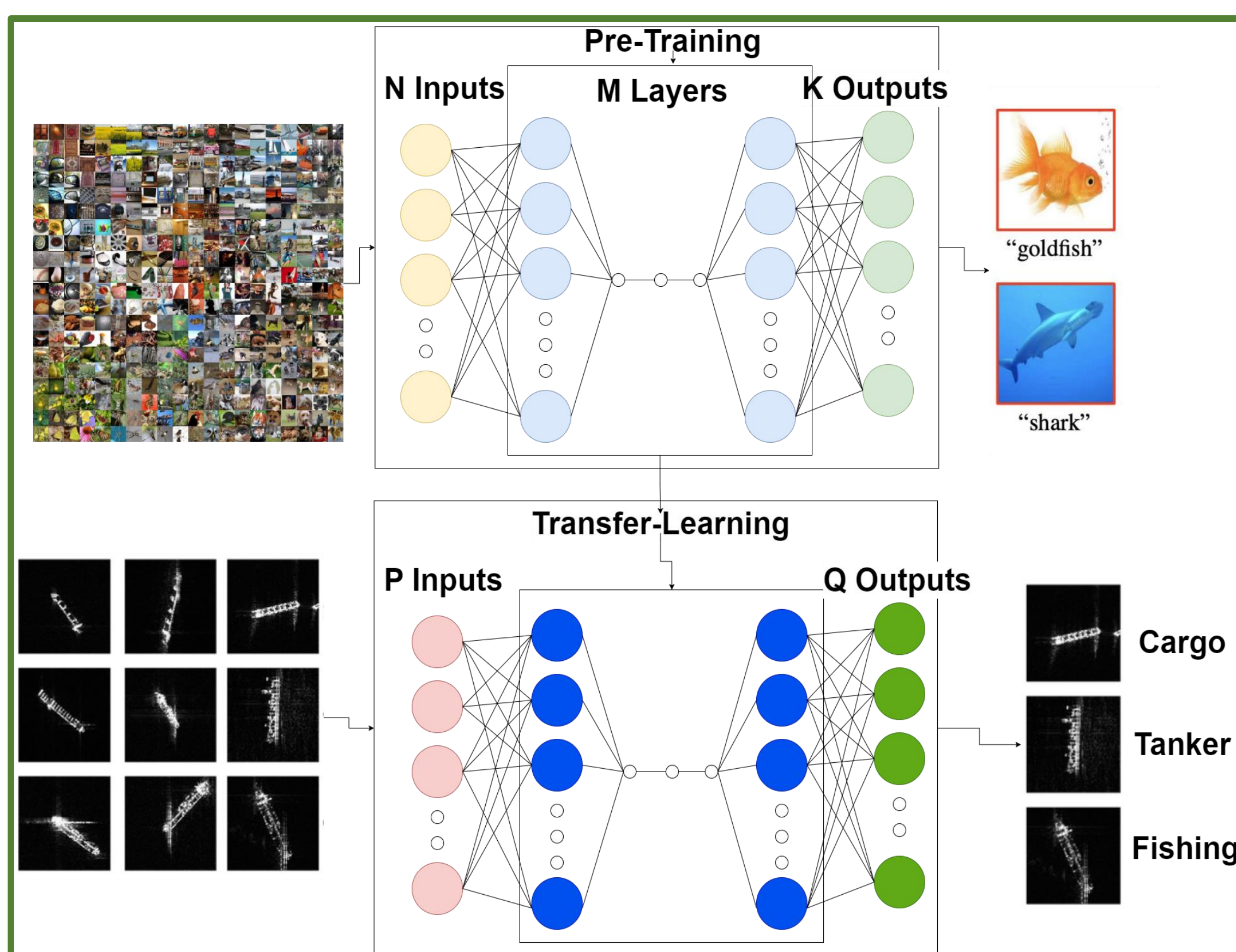
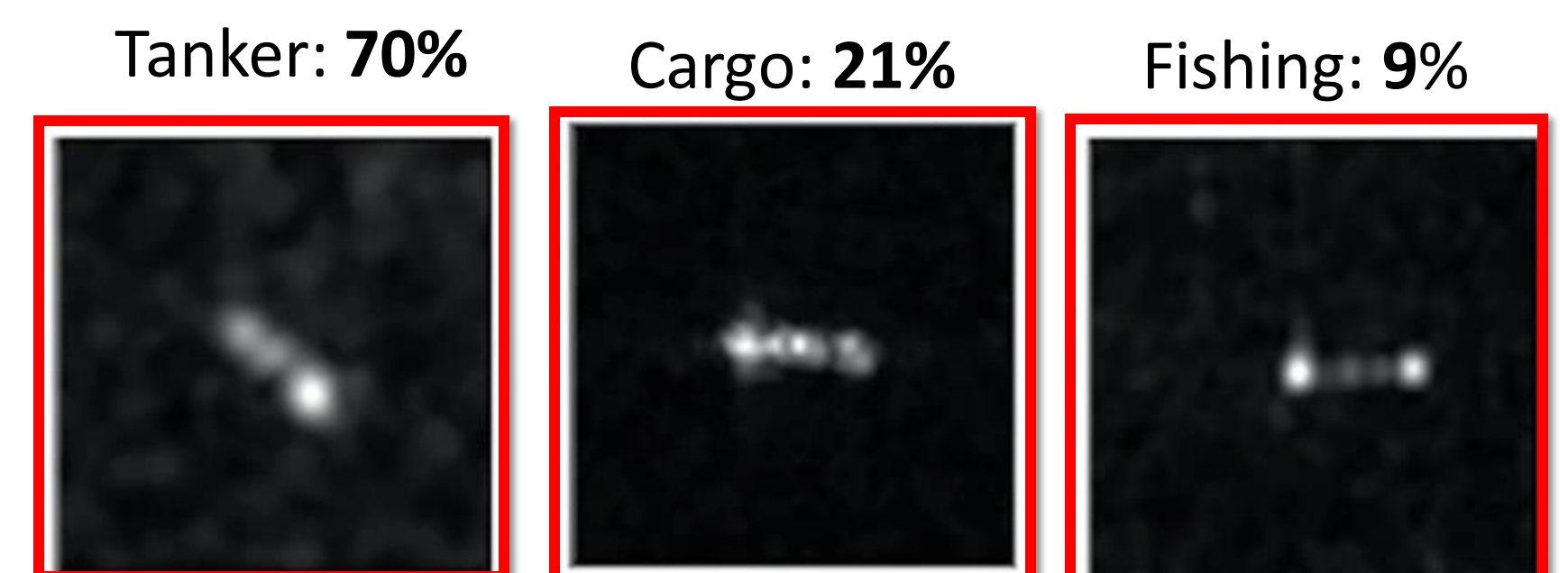
Imbalanced Datasets through the Lens of Transfer-Learning

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<https://github.com/cm-awais/transfer-learning-SAR>

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Introduction: Data scarcity and class imbalance hinder deep learning for tasks like SAR ship classification. This work investigates how **TRANSFER-LEARNING** and **DATA MERGING** techniques can significantly improve the performance of deep learning models for class imbalanced datasets.



Contributions:

1. **Fine-tuned deep learning models** for improved SAR ship classification.
2. **Created a combined SAR dataset.**
3. **Showcased transfer learning's potential** for overcoming limited SAR data with **data scarcity & imbalance.**

Experimental Setup: Data

- **Three classes:** Cargo, Tanker and Fishing.
- Two public datasets: FusarShip [1] and Opensarship [2].
- A new **dataset was created** by combining Fusar and Opensarship data.
- **F1-score** as the performance metric.

Experimental Setup: Models

Three out of five models were first trained on a base dataset and then fine-tuned twice on the other two datasets, whereas Pre-trained (VGG and Resnet) were first trained on ImageNet and then fine-tuned twice on other two datasets:

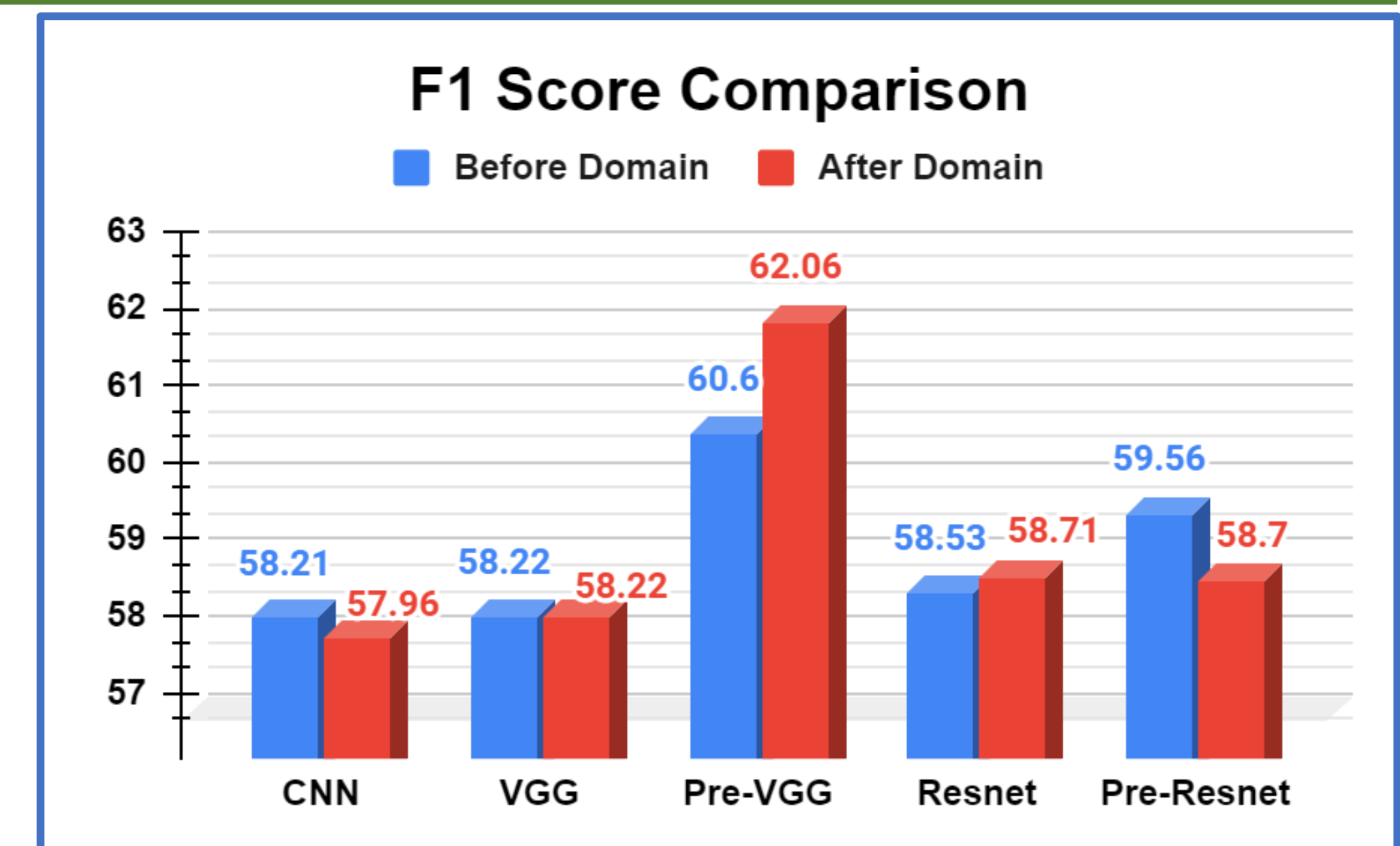
- **CNN, ResNet, VGG, Pre-trained Resnet, Pre-trained VGG.**

Results

1. **Fine-tuning** deep learning models, particularly **pre-trained VGG**, significantly **improved SAR ship classification performance** despite data scarcity and imbalance, with a new **combined dataset** further enhancing performance.

Summary:

1. We **explored fine-tuning** deep learning models for SAR ship classification, achieving significant accuracy gains.
2. We **tackled data scarcity and imbalance** by creating a new combined dataset and utilizing transfer learning, particularly with pre-trained VGG models.
3. Our research **paves the way** for **improved SAR ship classification** by showcasing the potential of transfer learning for overcoming data limitations.



Fine-tuning is the part of **Transfer-learning** which resumes the training process by freezing the network weights, except for the final layers. A new training set is then fed into the network, representing a specific domain. This allows the final layers to update their weights accordingly.

[1] Hou, Xiyue, et al. "FUSAR-Ship: Building a High-Resolution SAR-AIS Matchup Dataset of Gaofen-3 for Ship Detection and Recognition." Science China Information Sciences, vol. 63, 2020
 [2] Huang, Lanqing, et al. "OpenSARShip: A dataset dedicated to Sentinel-1 ship interpretation." IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 11.1 (2017): 195-208.