

Evaluating the Impact of Fine-tuning on Deep Learning Models for SAR Ship Classification

Ch Muhammad Awais^{1,2,3*}, Marco Reggiannini^{1,2,3}

¹National Research Council (CNR), Institute of Information Science and Technologies (ISTI), G. Moruzzi 1, 56124 Pisa, Italy

²University of Pisa, Pisa, Italy

³NBFC, National Biodiversity Future Center, Palermo 90133, Italy

Code Repo: <https://github.com/cm-awais/transfer-learning-SAR> *E-mail: chmuhammad.awais@cnr.it

Tasks like SAR ship classification suffer in deep learning due to data scarcity and class imbalance. To overcome these challenges, techniques like fine-tuning and data merging can play a vital role in the performance of a deep learning model. This study evaluates the effect of fine-tuning on 5 different deep learning models: CNN, ResNet, VGG, Pre-trained Resnet, Pre-trained VGG. Three classes (Cargo, Tanker and Fishing) were drawn from two public datasets (Fusar [1] and Opensarship [2]). Additionally, a new dataset was created by combining Fusar and Opensarship data. The performance of fine-tuning was evaluated on all three datasets. Due to class imbalance problems in the data, this study focuses on the F1-score as the performance metric.

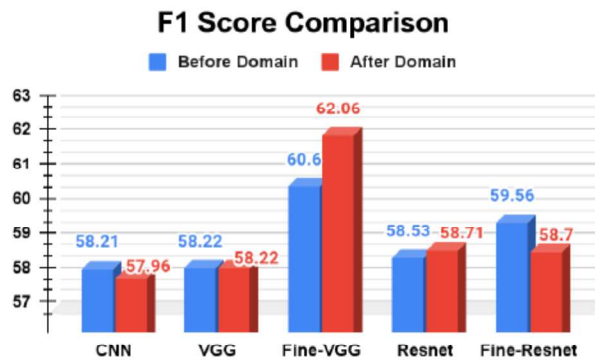


Figure 1: The average scores F1 scores before and after fine-tuning.

The models were first trained on a base dataset and then fine-tuned twice on the other two datasets. The results showed that pre-trained VGG (first trained on ImageNet dataset), followed by fine-tuning on other datasets, achieved a better F1-score than all other models (Figure 1). This indicates that strong structures like VGG, when pre-trained and fine-tuned on domain-specific datasets, can lead to better class representation. The results of this study highlight the importance of choosing the right model and the effectiveness of transfer-learning on imbalanced SAR datasets. Further analysis has the potential for even better ship classification performance.

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