

# **Machine Learning Based Parking Space Classification Using R-CNN and Faster R-CNN FPN Architecture**

## **Abstract**

This research work aims to create an accurate and economical model for classifying parking space using deep learning techniques. Using current advances in deep learning and computer vision, the proposed model solves urban mobility difficulties, particularly parking management. To address parking space occupancy classification, the research work suggests using two proven deep learning architectures, R-CNN (Region-based Convolutional Neural Networks) and Faster R-CNN FPN (Feature Pyramid Network), as well as insights from previous research. The proposed models take advantage of the R-CNN and Faster R-CNN FPN architectures. This solution uses binary classifiers, such as ResNet50, to assess image patches representing individual parking spaces and offer precise occupancy values. Furthermore, this research investigates the Faster R-CNN FPN architecture, which uses a feature pyramid network to record hierarchical information and reason about complex spatial configurations in parking lots. The proposed models stand out for their ability to use high-resolution photos from real-world parking lots, allowing them to learn discriminative features automatically from raw image data. This differs from traditional methods that rely on handcrafted features, allowing the models to manage a wide range of parking lot circumstances, including changes in weather, illumination, and occlusions caused by surrounding vehicles or barriers. This research intends demonstrate the improved performance and scalability of deep learning models for parking space occupancy classification by conducting extensive testing. Here the implementation method focuses on systematic data collection, annotation, pre-processing, and model training to create machine learning models that can reliably categorize parking spot occupancy, allowing for successful parking management solutions in real-world scenarios.