

All these research papers address the problem in automating the recognition process of products on racks and determining empty shelves using computer vision and deep learning (or machine learning). I am just going to mention the proposed solution of the people writing the research papers on how they can tackle this issues.

### **An Improved Deep Learning Approach for Product Recognition on Racks in Retail**

**Stores:** This research paper uses a two-step deep learning approach to improve effectiveness of recognition and memory requirements. The first step uses Faster-RCNN for object localization (detect regions of product) and second step uses ResNet-18 to classify these detected regions into appropriate classes. [1]

### **Shelf Auditing Based on Image Classification Using Semi-Supervised Deep Learning to Increase On-Shelf Availability in Grocery Stores:**

This research paper uses semi-supervised learning to automate on-shelf availability (OSA) to automate OSA monitoring using YOLOv4 deep learning model. This method is useful because OSA requires a lot of manual annotation and through SOSA XAI, this can be done in an effective way. [2]

### **A Deep Learning Framework for Grocery Product Detection and Recognition:**

This research paper uses YOLOv5 deep learning model for detecting retail products and SCATTER algorithm for text recognition of brand names. This model is useful for not only detecting products, but also provides assistance for visually impaired shoppers. [3]

### **Towards Intelligent Retail: Automated On-Shelf Availability Estimation Using a**

**Depth Camera:** This research paper uses a consumer grade depth sensor for detection on-shelf availability (OSA) situations. It uses 3D point cloud reconstruction and modeling techniques for estimating the availability of product without the prior knowledge of that product, giving a cost-effective and time saving solution. [4]

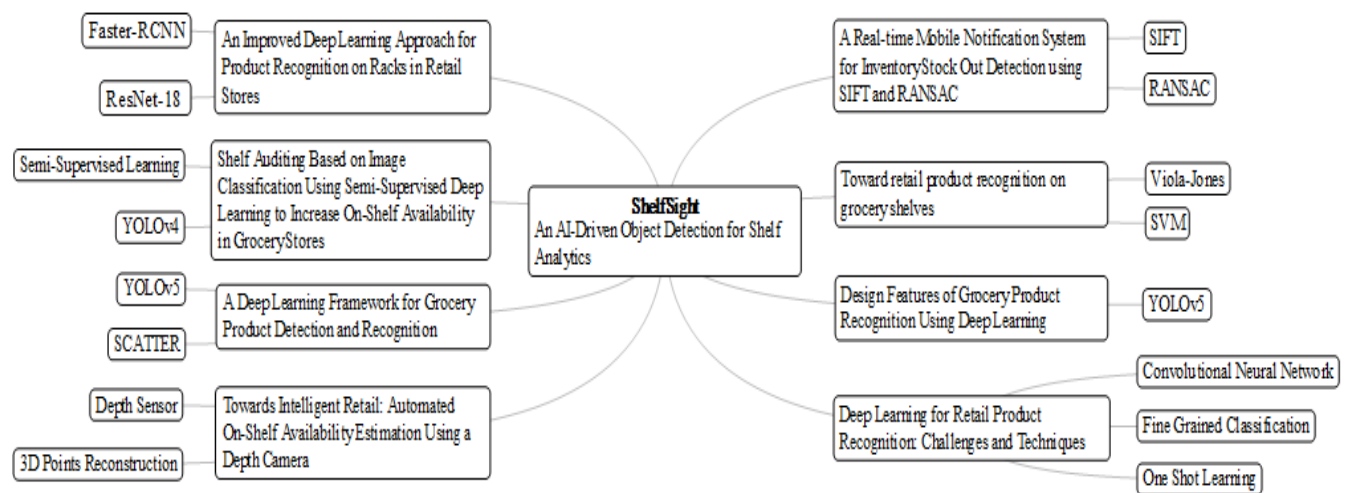
### **A Real-time Mobile Notification System for Inventory Stock Out Detection using**

**SIFT and RANSAC:** This research paper uses SIFT and RANSAC algorithms for detecting products in image form. When a particular product runs out of stock, this algorithm detects the logo on the product and creates a real-time notification for reordering. This solution offers a low cost and efficient way to automate inventory. [5]

**Toward retail product recognition on grocery shelves:** This research paper divides the problem into two steps; detection for finding the product and detection for identifying the brand, using Viola-Jones cascade object detection framework and SVM. This research has applications planogram compliance control, inventory management, and assisting visually impaired people during shopping. [6]

**Design Features of Grocery Product Recognition Using Deep Learning:** This research paper uses a two-stage pipeline model to detect products in a grocery store; first stage involves using YOLOv5 to locate specific objects in images and second stage focuses on using shape, size, and color to reduce false detections and improve difference finding between similar products. [7]

**Deep Learning for Retail Product Recognition: Challenges and Techniques:** This research paper address major problems like large-scale classification, data limitation, intra-class variation and uses approaches like CNN-based feature descriptors, data augmentation, fine-grained classification and one-shot learning to solve them. [8]



## References:

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