**Image Feature Detection & Count Using Computer Vision**

**Executive Summary**

The team worked with ATCO Industries Inc whose primary business is quality inspection, quality sorting, and containment services working mainly with automotive manufacturers. The primary objective of this project is to use machine learning to identify and count the number of instances of a certain feature present in the object image. The expected value of this project is to improve upon the current process at ATCO, which is manual, time-consuming, and lacks real-time feedback on the inspection and detection results. Likewise, the current process lacks any comprehensive documentation and storing of the inspection results, which is limited to rejected parts. ATCO deems this project as a proof of concept to evaluate if an efficient and effective machine learning solution can help improve its operations. The company ultimately wants to automate its inspection process to provide real-time feedback on the inspection and results and provide a complete collection of every inspected part.

The team researched and tested multiple image processing solutions, including YOLO Object Detection, HSV Color Space Tracking and Detection, and One-Shot Learning. However, none of these techniques provided a dynamic and feasible solution that works on any industrial part with a user-friendly interface and with minimal user input. The team determined that Template Matching, an algorithm in the OpenCV library, is the best solution to the given problem. It computes the pixel to pixel match between a feature image and a source image of the entire inspect part. Though the method is rigid as a standalone algorithm, the team added multiple features to make the method more dynamic and flexible, such as rotation, scaling, warping adjustment, and threshold tuning. Most importantly, the designed program can process a batch of images using a single feature template image. The team tested the final product on multiple images while adjusting for different parameters. The team documented the limitations and recommended methods on how to overcome the limitations to produce the best detection accuracy. Lastly, the team details the future scope of this project which entails deployment of a production version on Android devices and leveraging an image database to create advanced machine learning and computer vision models.