Product Auto-Trigger System

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Abstract

The importance of ensuring flawless and less defective production in modern industries is immense but it is challenging due to different production factors. Large scale industries are investing in AI and more specifically computer vision for defect detection. The objective of this research is to find anomalies in repetitive and periodic production cycle with continuous flow.

To detect defects, our software takes snapshots of products on conveyor and informs workers when there are any discrepancies. For accurate detection without sensors, we suggest an auto-trigger algorithm which takes the best products frames from fast production flows based on sample images.

Ⅰ. Introduction

In modern industry, they ensure all the products are flawless to reduce expense and time and protect their machines. However, it is not easy to control the quality of all products. There are so many factors that cause damage during production that happen every time. If they just let the products defect, it will slow the supply chain to export due to restricting product recheck. Some products can only be restored immediately, otherwise they need to depose the defective products.

To solve this problem, big industries invest enormous budgets in AI to detect defects in particular steps before it is too late. Computer vision acts as a crucial part of AI in anomaly detection.

In this research, we are working on anomaly detection that happens on products. In many factories, they suffer from anomalies in their production because they have so many machines and it is a non-stoppable flow, so it is not possible to control the situation.

Our anomaly detection software helps the industry to detect defective products by using algorithms to capture images of product trays directly while flowing and start detecting if anomalies exist, it alerts the worker to know.

Without any sensor, getting clear images for each cycle is a challenge. The precision of anomaly detection is dependent on how good the images are. If we are not able to find a good frame, detected anomalies become false. In this case, we work hard to guarantee the accuracy of the product's perfect timing frame capture to detect anomalies. We would like to propose an auto-trigger as an algorithm to find the best product's frame based on a sample image. As the fast product flow our algorithm can capture every cycle of products without any assistance from sensors.

II. Methodology

Auto-trigger is the method of selecting one frame of products that appear in camera vision to apply further quality check like: quality analysis, anomaly detection, etc.

In auto-trigger, the goal is to find the best image to detect anomaly. We divide input into 2 parts: Reference input and batch input. The reference input is the sample of the image that we want the output to look like. The batch input is the images that contain products per cycle to find 1 image that most like the reference. The output is an image that has been chosen among the batch input.

Reference frame for auto-trigger

For the anomaly detection project, we have 2 reference images because camera vision cannot reach the entire product, but we separately store it.

For each reference, we draw the region of interest "ROI" of the product in Figure 1.

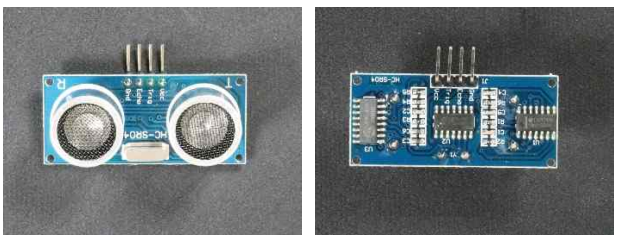

Figure 1 1st and 2nd reference images with ROI. We have 3 products inside a camera view.

Feature Extraction

Feature extraction is the term used for creating meaningful representations from raw data to enable computers to recognize and analyze complex patterns. It also plays a crucial role in computer vision which helps in image analysis and understanding. We can employ knowledge obtained from large image datasets by extracting features from already trained neural networks, thereby improving the performance of a task. In this case, we extract characteristics for two subtracting layers in the original using ResNet18 [1] as our pre-trained model. We perform feature extraction for every batch frame and reference image that we have from the real-time camera in Figure 2 and Figure 3.

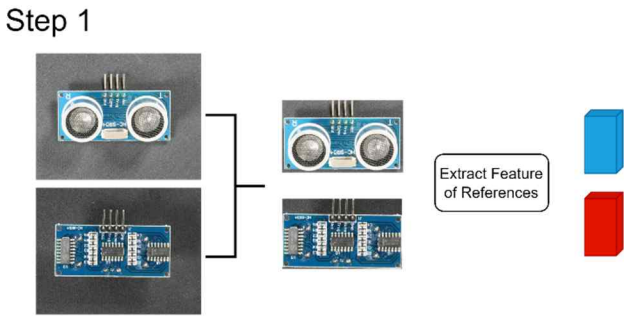

Figure 2 Extract features of both references to compare with features of the inferences.

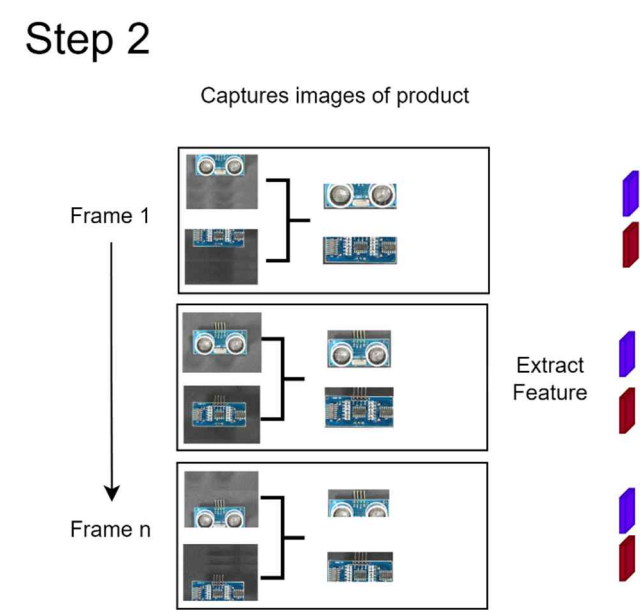

Figure 3 Extract features of all inferences images that contain the product.

After extracting the images' features, we compare all the batch frame features with the reference feature using cosine similarity. The scale of comparison is from 0 to 1. We pick the highest score images as the best match to the reference in Figure 4.

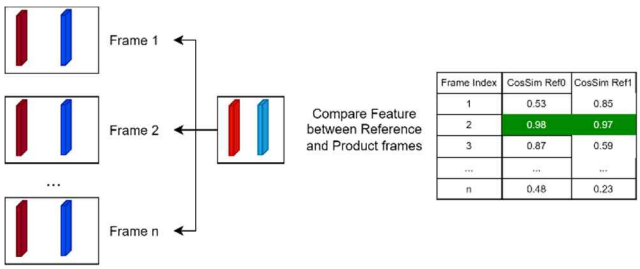

Figure 4 Calculate CosSim between the Reference Feature and the Inference Feature and select the image with the highest score.

III. Conclusion

To succeed in anomaly detection, finding the best image for each cycle is very important. Normally, there are sensors to handle the product's arrival. We try to implement our auto-trigger algorithm to trigger products with real-time cameras in case the factory is not able to attach the sensor. We use feature extraction to get features to compare with the reference images to the batch frames and use cosine similarity to compare each feature to find the top score and pick it as the trigger image. Some factors affect our algorithm if the light condition is not stable and low fps camera issue. In the future, we will improve it to reduce the problems.

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REFERENCE

[1] D. V. R. G. D. L. S. Allena Venkata Sai Abhishek, "Resnet18 Model With Sequential Layer For Computing Accuracy On Image Classification Dataset," 2022.