Belt Conveyor Fault Detector Using Computer Vision

Description

Conveyor belts move material between two points in a process, making it essential to keep this operation under control. However, belts are subject to wear, tears, misalignment, and breaks that are difficult for the human eye to detect while the belt is moving, affecting operational continuity. STGI Mining has developed a system (Figure 1) designed to detect four conveyor belt failure modes: wear, tears, splice failure, and misalignment damage.

Detection is performed by an algorithm that uses artificial intelligence to identify anomalous sections in belt images (Figure 2), a technique known as deep learning. The system consists of a digital camera, a processor, a data collector, and a light source. It is installed at a strategic point beneath the belt to be monitored, providing continuous process monitoring and generating alerts according to the detected failure.



Figure 1: Detection System

Conveyor Belt Failures



Figure 2: Detectable Faults

Solution Benefits

The system supports the business in the following areas:

1 - Prevent risks and improve personnel and equipment safety.

2 - Increase belt availability and service life.

3 - Increase the interval between maintenance activities (MTBF).

4 - Reduce emergencies associated with unexpected failures.

5 - Reduce maintenance costs.

6 - Improve production quality.

Operation

The system operates in six stages (Figure 3). Once the image is captured, a 500 × 500-pixel section is cropped. Using this new digital image, the previously trained algorithm extracts useful features to identify anomalous sections associated with the defined faults. When the algorithm detects a fault, it sends an alert to the operator interface to support decision-making.

The algorithm uses a CNN (Figure 4), a deep learning tool with a pretrained model capable of detecting a variety of objects in images and video in real time. In this system, the network detects the four patterns representing the previously described faults.

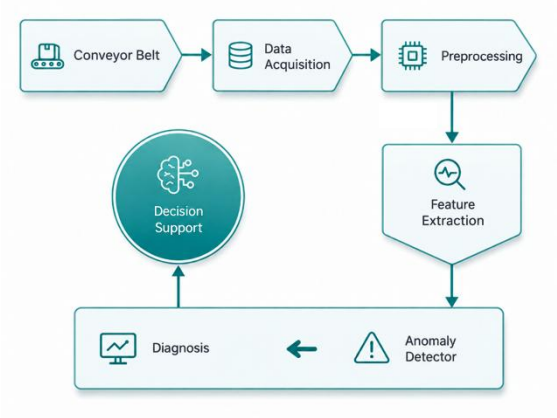


Figure 3: Workflow

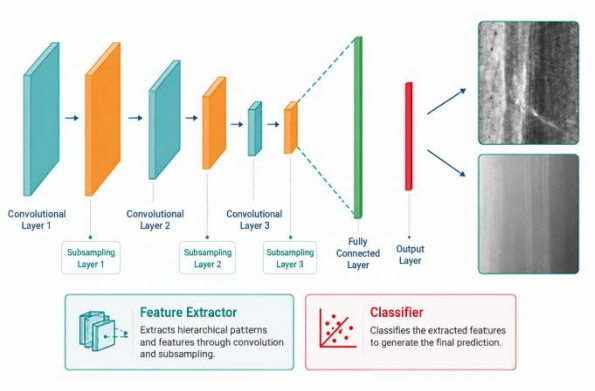


Figure 4: STGI Computer Vision Algorithm

Product

STGI Mining has developed a product (Figure 5) using IIoT technologies that provides preventive alerts on conveyor belt condition through a simple graphical interface.

This enables real-time visualization of belt condition to anticipate maintenance needs and improve production indicators.

The system also provides reports that allow users to analyze the relationship between process and equipment variables, including faults and related operating indicators.

STGI Mining sensing units require no maintenance, and their installation and placement are non-invasive.



Figure 5: Installed STGI System

Decision-Making Support

1 - Prioritize systems requiring maintenance.
2 - Implement improvements to the maintenance plan.
3 - Predict failures.
4 - Increase MTBF.
5 - Improve equipment availability and reliability.

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