Turbine Vane Defect Detection With Computer Vision

Howmet Aerospace

Shripad Akumalla, Gavin Bowden, Jaewook Lee, Henry Nguyen, Habibur Rahman, Sumukh Vaidya

OVERVIEW

• Manufacturing aerospace parts is challenging due to strict tolerances and requirements. Therefore, identifying defects is crucial. We partnered with Howmet Aerospace to develop a machine learning model to quickly and reliably flag defective engine turbine vanes from x-ray images.

• We modified an open-source image classifier and train it on data provided by Howmet Aerospace.

• It is important to identify defects in the manufacturing process to improve product reliability, reduce cost and enhance safety.

Image processing

Program takes direct X-Ray image and processes it into a filtered image for classification (creating a complete data pipeline)

Results

Model achieve increasingly high accuracy over training epoch but no improvement on negative predictive value. Additionally, loss increases over time between training and validation, highlighting model overfitting training data.

Future Works

I. Increase model’s defect detection accuracy rate.

II. Broadening the model’s detection to encompass diverse defect types.

III. Extending the model’s applicability to encompass varied turbine vane designs.

IV. Implement image segmentation and bounding box around defective areas.

References


Conclusions

The accuracy achieved is ~94%, which is an improvement over the 87% accuracy of human-only classification. However, the model suffers from low negative predictive value.

In conclusion, the model is not yet suitable for implementation in the aerospace industry. Its ability to accurately detect defective parts remains a challenge. Addressing this challenge requires additional training data, which pose as a bottle neck to the success of this project due to the lack of available of such data.

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