Identifying Defects in Perovskite Thin Films Using Machine Vision

Sanskar Srivastava, Computer Science
Mentor: Nicholas Rolston, School of Electrical, Computer and Energy Engineering
School of Computing and Augmented Intelligence

Introduction

- Perovskites are generating excitement among scientists due to their affordability, simplicity of fabrication, and customizable properties.
- Perovskites are high in efficiency and can be produced in low cost but there is also some cons to it like, while coating the perovskite there can be defects.
- Defects can be of many types like: pinhole, grain boundaries and scratches. Using the defected perovskite is not that efficient, therefore I researched on detecting defects using Machine Learning algorithm.

Algorithm

- In the script we are using pre-trained convolutional neural network model called VGG16. It is a very common tool for image classification.
- We are mainly using K-means algorithm to extract visual patterns and characteristics of image. Then we are grouping the images based on it.
- Then the code tries identify the defects in image and make a box around them so that defects can be distinguished.

Analysis & Future work

- The performance of the code highly depends on the image. If the image is well-defined in contrast, then only it is able to identify defects.
- The code for now is just able to identify pinholes but in the future we plan to make it work for grain boundaries and scratches. .
- Also in future we will add a segment to the code which will turn the image to black-white image.

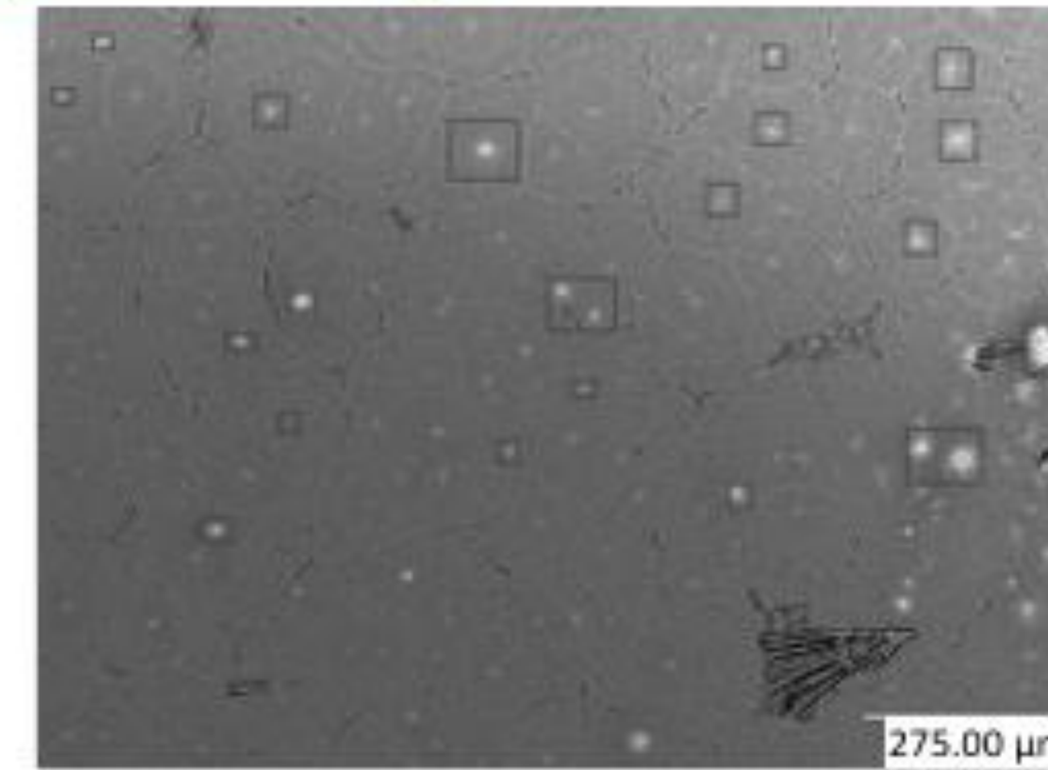

Figure 1

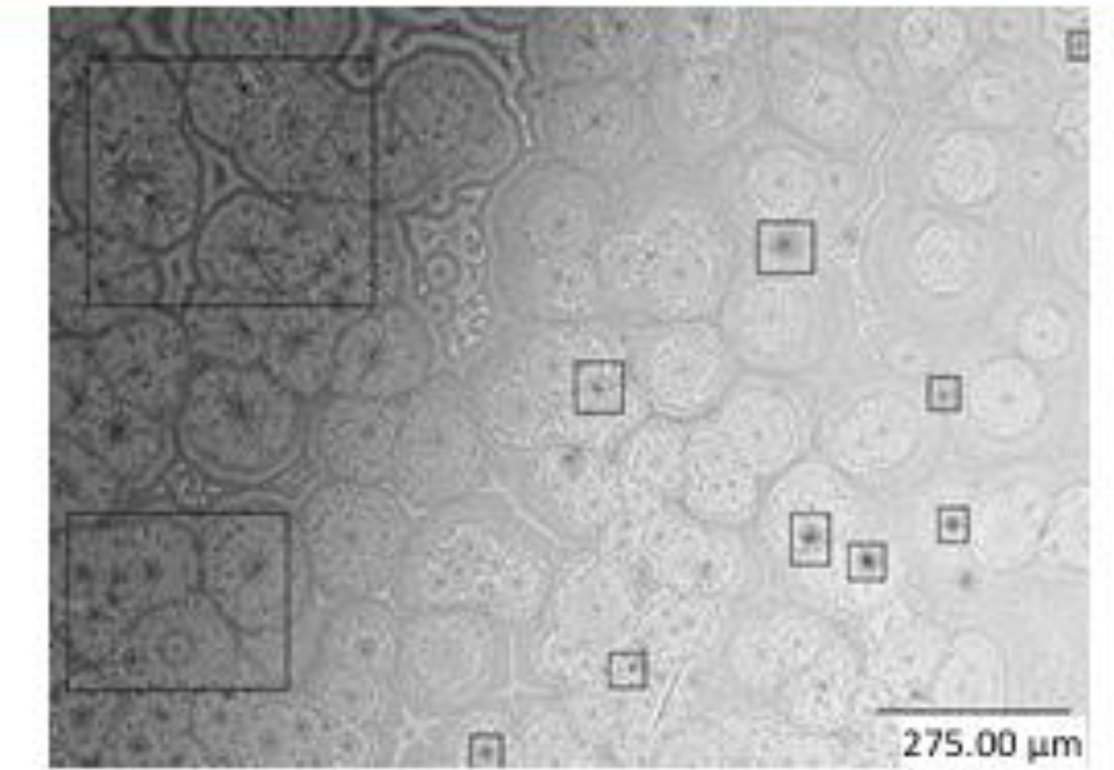

Figure 2

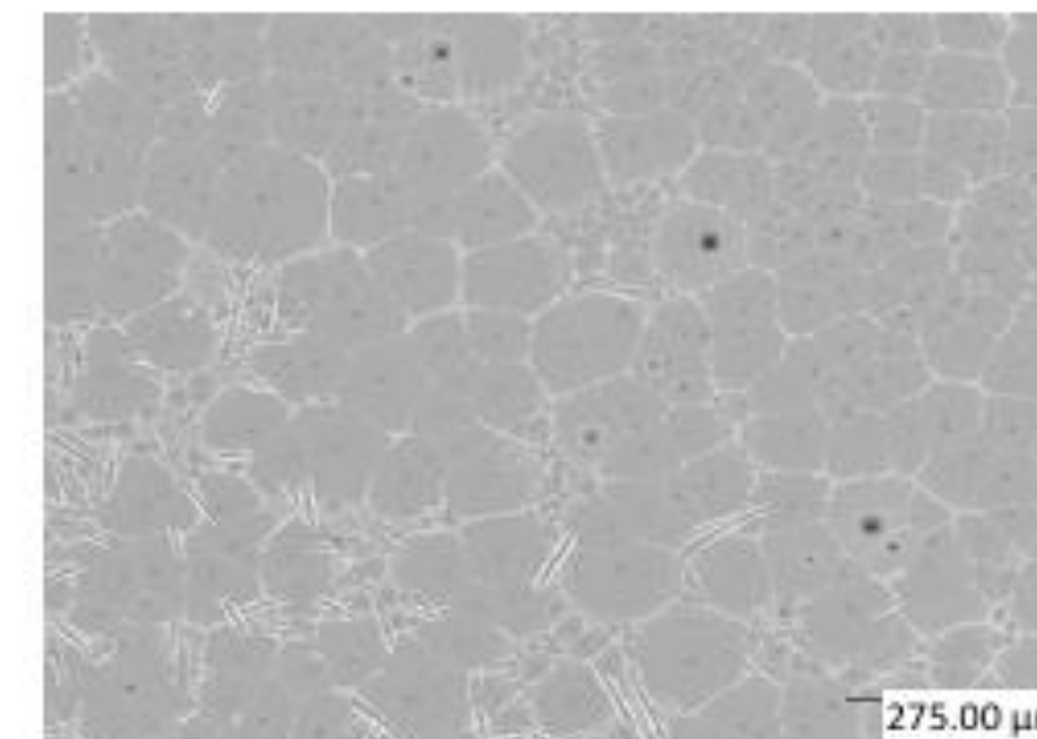

Figure 3

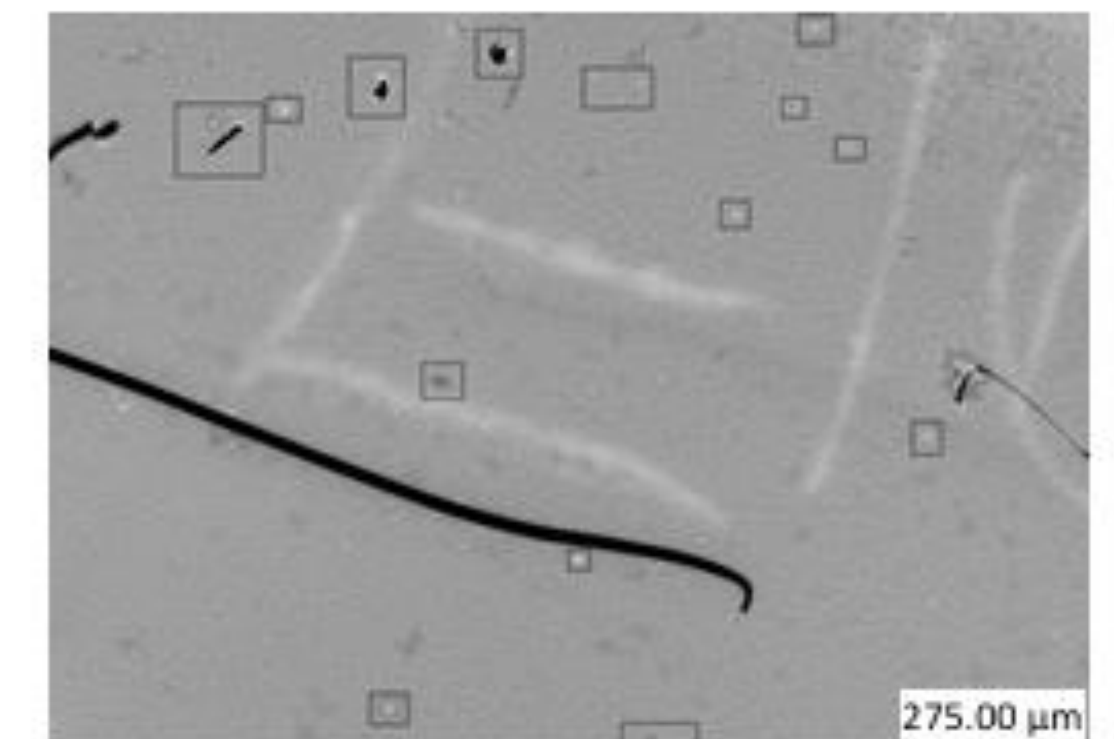

Figure 4

1. The boxes in the image tells that the defect has been identified.
2. In figure 1, The code works best, it is able to identify most of the defects.
3. In figure 2 & 3, The code is able to identify the pinhole but not the grain boundaries and scratches.
4. In figure 4, The code just marks the pinhole but is unable to identify the scratches.

I would like to acknowledge my mentor Professor Nicholas Rolson for all the help and my peer Sanjin Gonilovic for allowing me to use their code.

Reference

- Great Learning. (2022, January 5). Everything you need to know about VGG16 - Great Learning - Medium. Medium. : https://medium.com/@mygreatlearning/everything-you-need-to-know-about-vgg16-7315defb5918
- Taherimakhsousi, N., MacLeod, B. P., Parlane, F. G. L., Morrissey, T. D., Booker, E. P., Dettelbach, K. E., & Berlinguette, C. P. (2020). Quantifying defects in thin films using machine vision. Npj Computational Materials, 6(1). https://doi.org/10.1038/s41524-020-00380-w
- *CS221*. (n.d.). https://stanford.edu/~cpiech/cs221/handouts/kmeans.html

FURI

ASU Ira A. Fulton Schools of Engineering
Arizona State University

Activate Windows
Go to Settings