AI Wind Turbine Imaging Research:
Computer Vision and Image Processing projects

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WIND POWER LAB
Global Blade Optimisation

Introduction

Our research group is interested on automatizing wind turbine blade assessments by using just images or videos. To construct an end-to-end algorithm capable of it, distinct research projects must be carried out, which are presented on the poster. The blade assessments will be employed to specify the required repairs.

These projects entail computer vision and machine learning research applied to the wind energy industry and will be supported by the Danish company Wind Power LAB.

Image Segmentation

Research problem:
Given an image of a blade, we would like to obtain a binary image of the same size, which indicates whether each pixel belongs to the blade or the background region.

Motivation:
This tool would be used as a preprocessing step. It would help our object detection algorithm to detect defects, and it would allow our mosaic algorithm to stitch each part of the image (which is used to locate the defects).

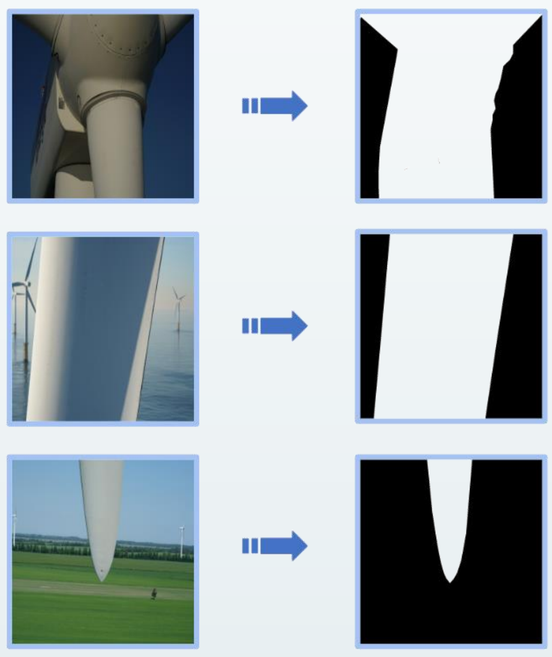

Fig. 1: Four image instances with different levels of shape and size where the blade region is pixel-wise identified.

Image Compression

Research problem:
Given an image of a blade, we would like to convert it to an encoded compressed representation by capturing its spatial redundancies.

Motivation:
Efficient image compression is essential to transfer large amount of drone inspection data to the cloud for further processing. Especially when wind turbines are installed in remote locations either onshore or offshore with limited communication bandwidth. Additionally, it reduces storage costs.

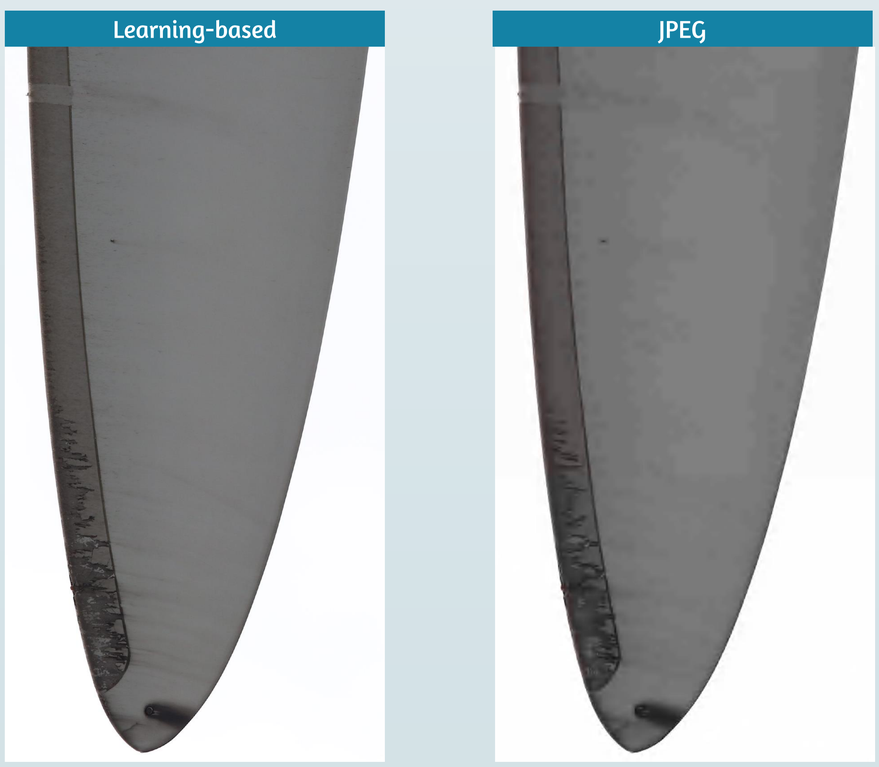

Fig. 2: Comparison of the same image after decompressing it using a machine learning-based compression algorithm and after using JPEG.

3D SLAM & Image Stitching

Research problem:
Given a set of images or a video from the same wind turbine blade, we would like to construct a mosaic / 3D model of the blade. In particular, the algorithm should aim to stitch each pair of images or frames to finally construct the whole view of the wind turbine blade.

Motivation:
This tool would be used for defect localization, because after detecting a defect in a single image, we cannot infer where is exactly located on the blade. Hence, it would help to determine where the blade must be repaired.

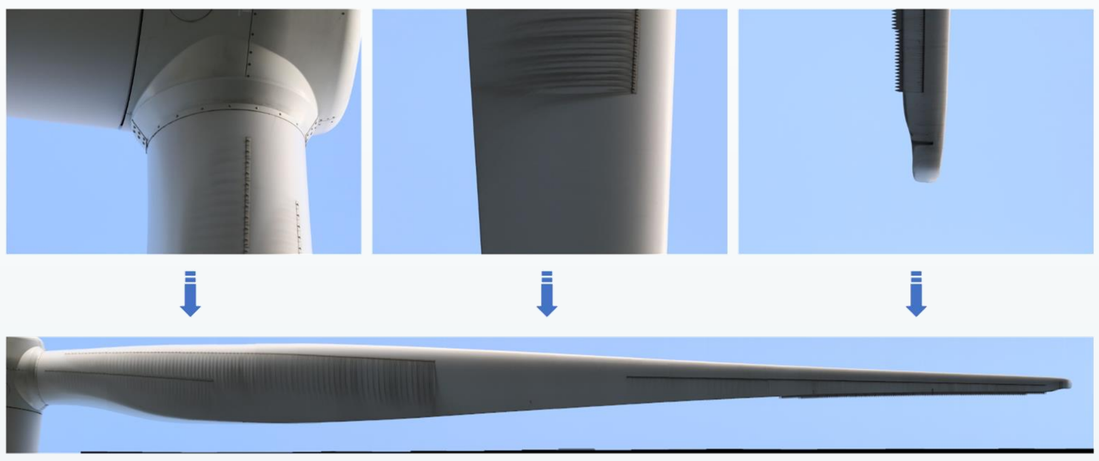

Fig. 3: By stitching each pair of images taken by the drone, we aim to build a full panoramic view of the wind turbine blade.

Fig. 4: Given an internal blade video, we would like to know where the drone is recording the video in each time. In this way, we can match the external defects with the internal ones.

Defect Detection

Research problem:
Given a color image of a wind turbine blade taken during a drone inspection, we seek to detect multiple defects in this image and localize these defects by outlining a rectangle over them called bounding boxes.

Motivation:
This algorithm would outline the distinct blade defects which are core to provide a complete blade defect assessment and its according repair plan.

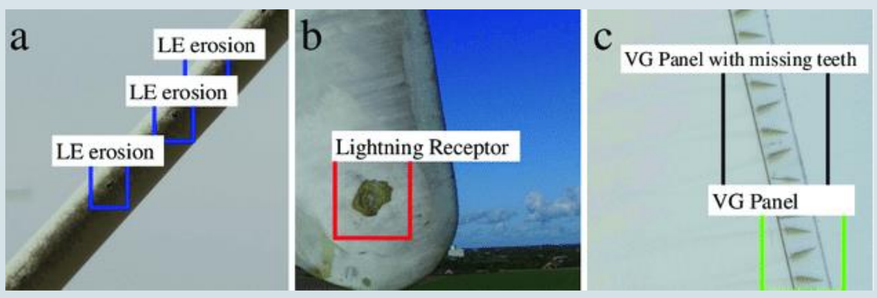

Fig. 5: Common blade defects that appear after the tear and wear of wind turbines.