IPI IMAGE PROCESSING AND INTERPRETATION | GHENT UNIVERSITY

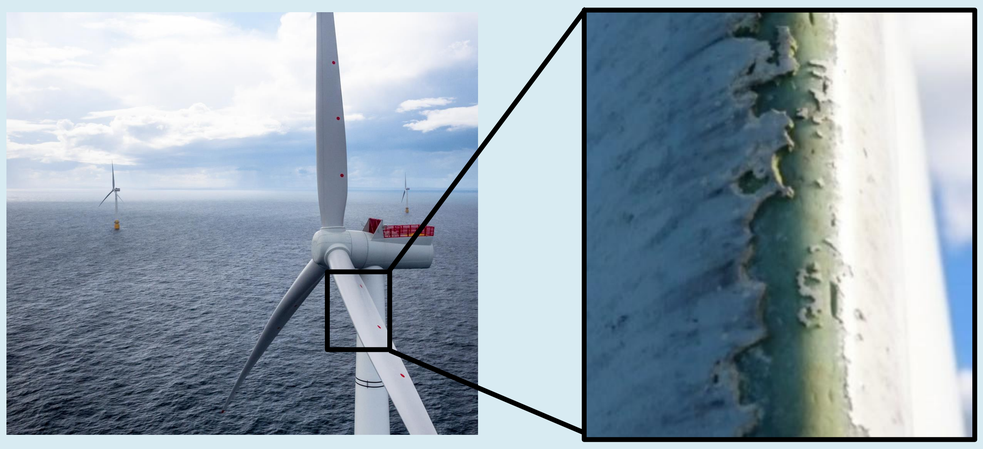
BLADE LEADING EDGE EROSION PREDICTION & DRONE-BASED INSPECTION (BLEEPID)

UAV Research Centre

JONATHAN STERCKX, ANH MINH TRUONG, MICHIEL VLAMINCK, HIEP LUONG

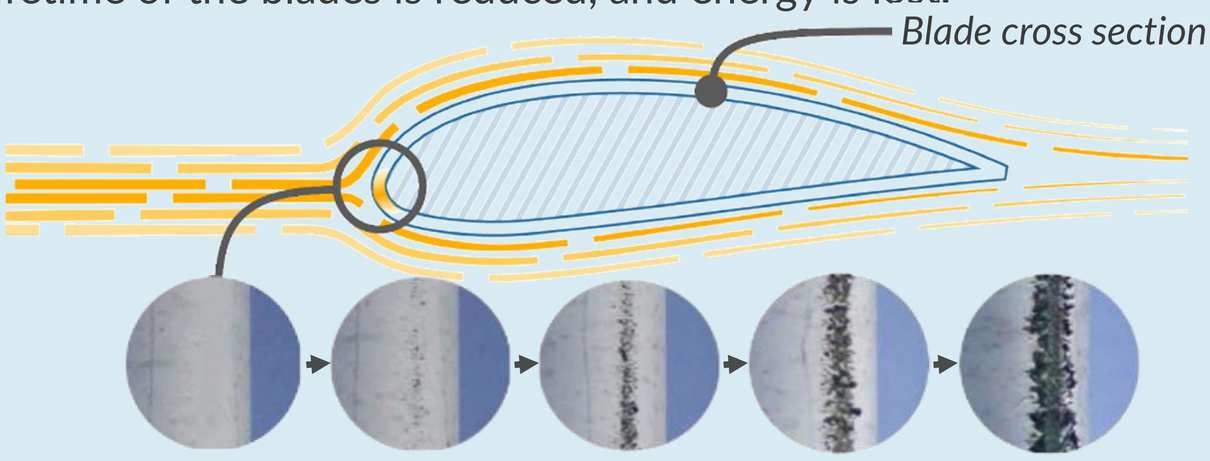
WEAR QUANTIFICATION BY DRONE-CAPTURED HIGH-RESOLUTION IMAGES

MOTIVATION



BACKGROUND

Air and water particles hit the leading edges at high speeds, causing erosion over time. The aerodynamic efficiency and lifetime of the blades is reduced, and energy is lost.



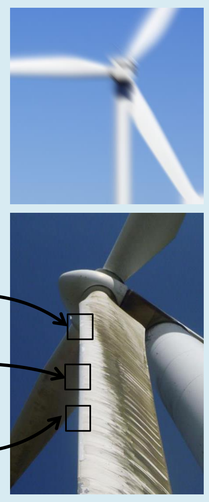
OBJECTIVE

Obtaining a sub-mm accurate 3D model of the leading edge forms the basis for the quantification and prediction of erosion on wind turbine blades.

CHALLENGES

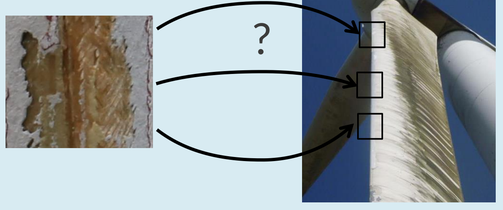
OBTAINING SHARP IMAGES

Wind → motion of drone and blade → motion blur
Even if turbine is turned off, it still moves.



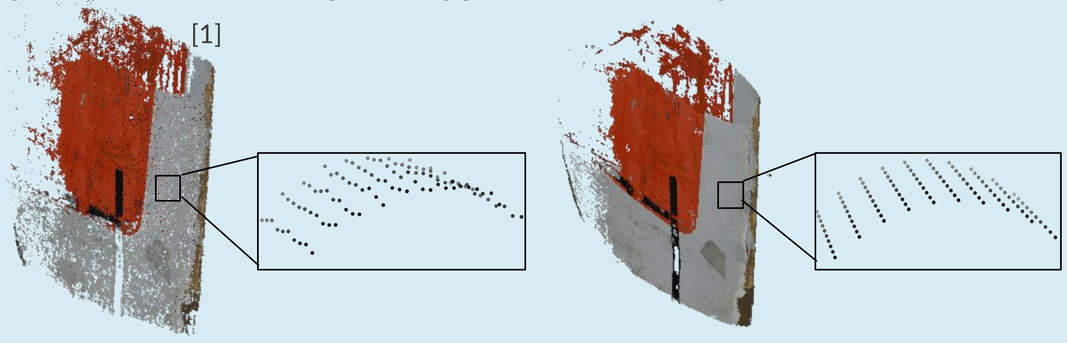
LOCALIZING DEFECTS

Close-up images show the defects, but not where they are.



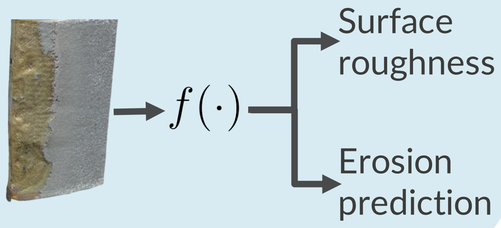
ACCURATE 3D RECONSTRUCTION

Requires lots of unique keypoints & sub-pixel accurate matches.



EFFICIENTLY QUANTIFYING WEAR

Deep neural networks do not efficiently process 3D point clouds.

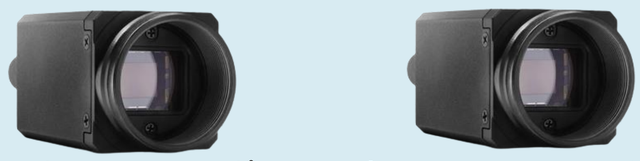


WORKFLOW

ASSISTED DEBLURRING

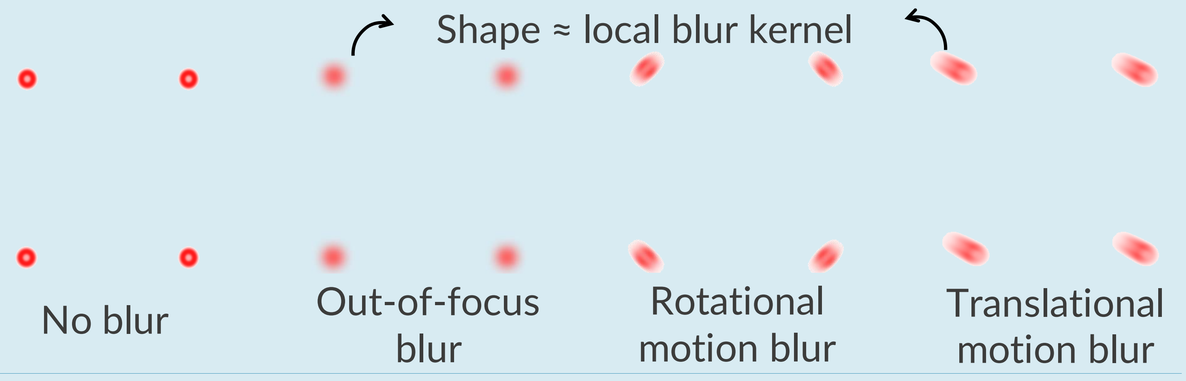
To remove non-stationary blur from the images

- HDR:



- Laser projection:

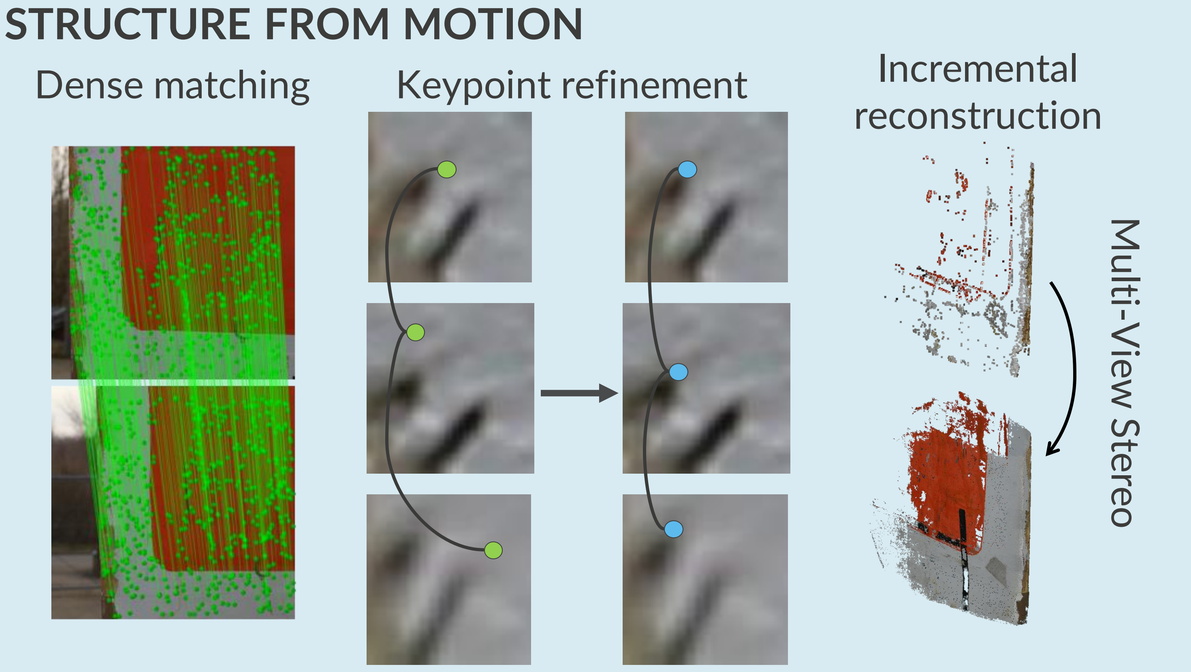
  The shape of smeared-out laser dot projections will be used to guide the deconvolution.



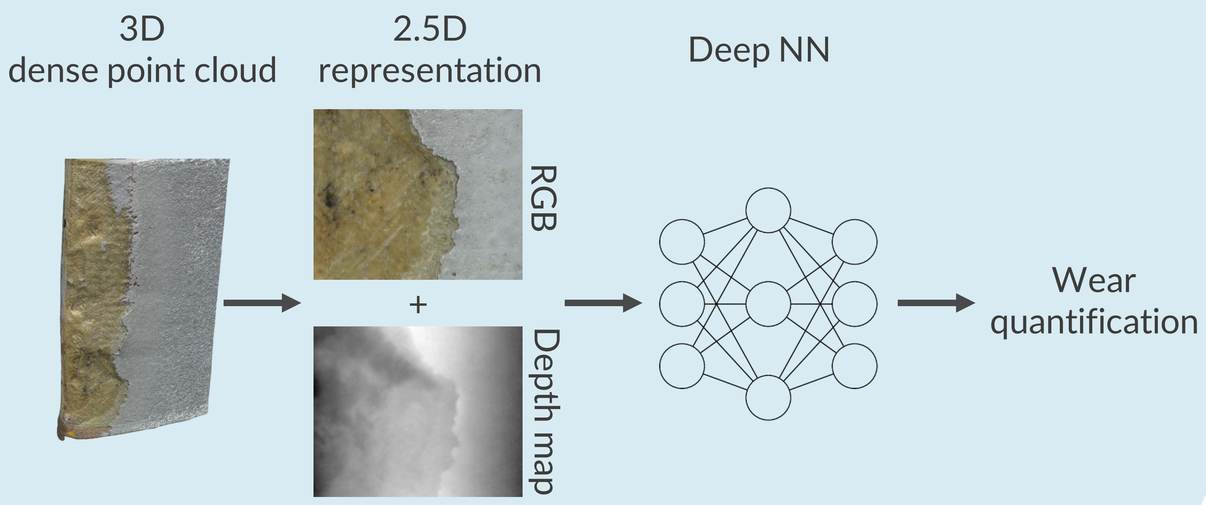
LIDAR + SLAM

To localize the drone's position w.r.t. the blade
To navigate autonomously

STRUCTURE FROM MOTION



EROSION ASSESSMENT



ENGIE Laborelec | OWI lab | sirris | economie FOD Economie, K.M.O., Middenstand en Energie

[1] Nikolov, Ivan; Madsen, Claus (2020), "Wind Turbine Blade SfM Image Capturing Setups", Mendeley Data, V1, doi: 10.17632/fptxw8cynv.1

imec

https://ipi.ugent.be https://urc.ugent.be jonathan.sterckx@ugent.be