






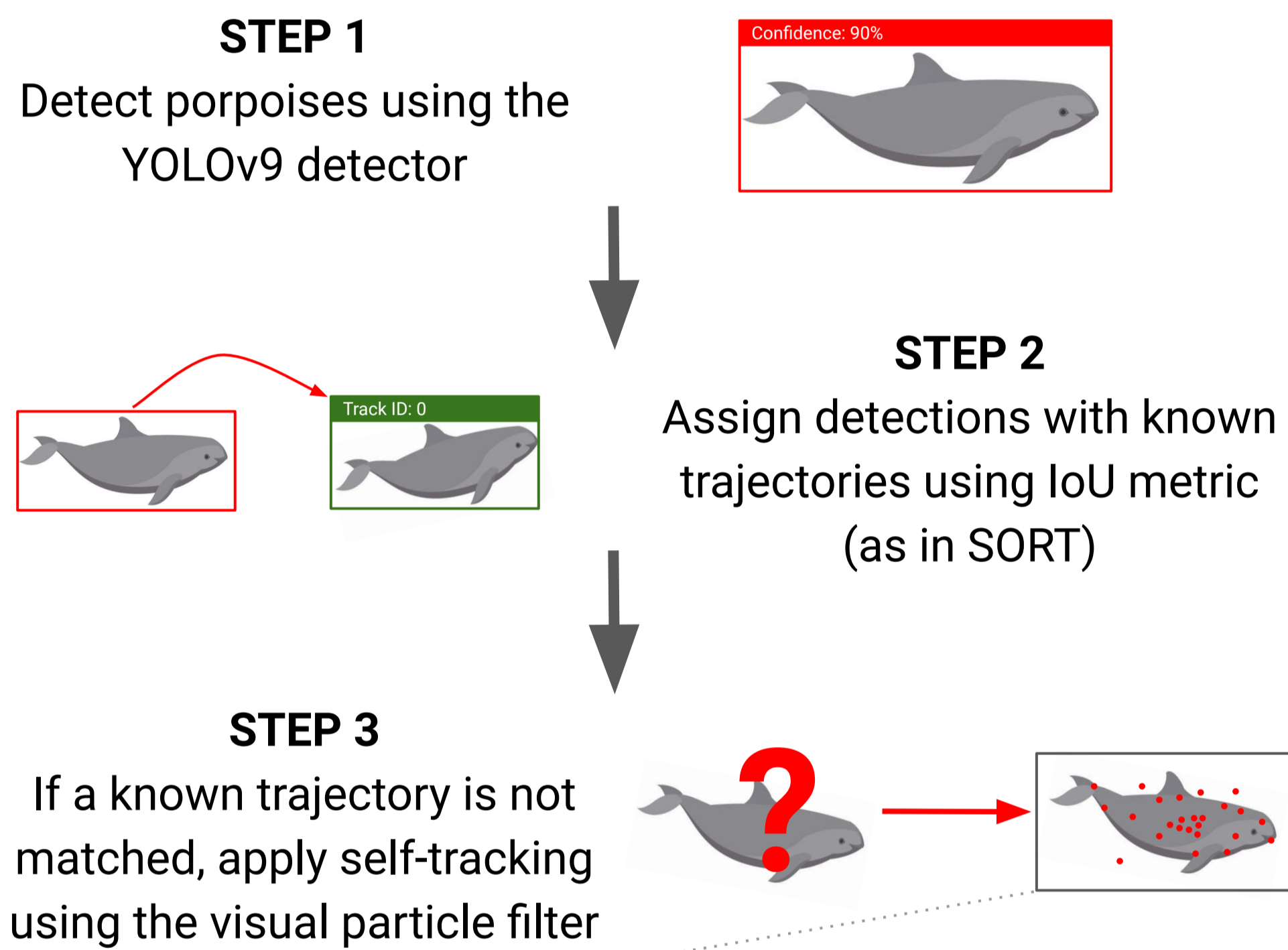
Making marine biologists' life easier with computer vision - porpoise detection and tracking in coastal waters

Bartosz Ptak | Poznan University of Technology
 Henrik Skov Midtiby | University of Southern Denmark
 Marek Kraft | Poznan University of Technology

Highlights

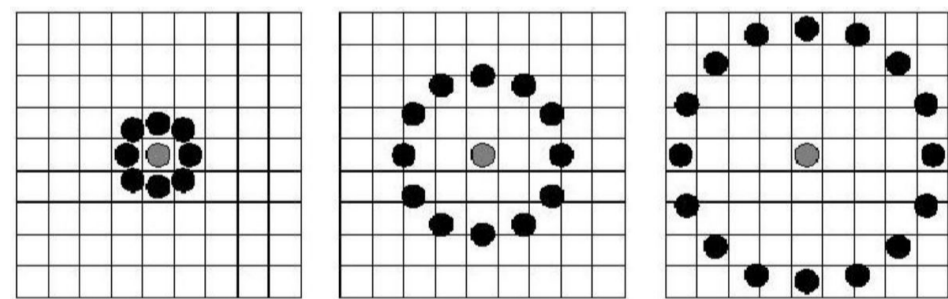
-  Monitoring marine mammals is a key task for biologists as it helps ensure animals' health and condition.
-  We improved the SORT tracker by using visual particle filter for better management of missing detections.
-  We shared very first publicly available dataset for drone-based porpoise tracking.

Method



1. Initialise random particles using centre and shape of known bounding box from the previous frame.

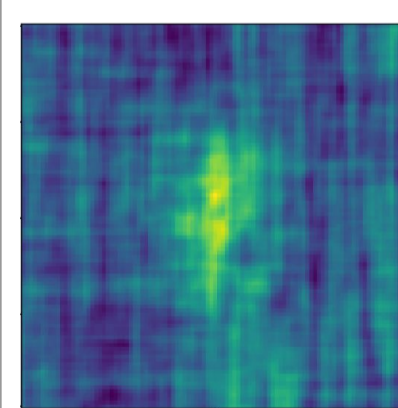
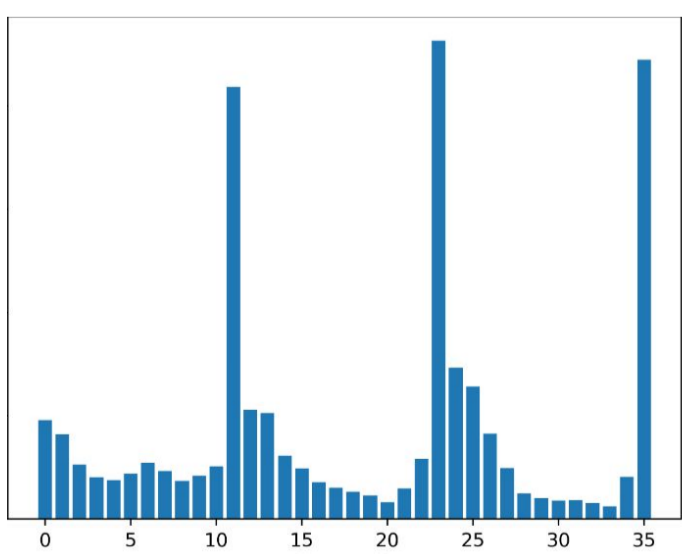
2. Considering the porpoise ROI in the previous frame, calculate the mixture of local binary patterns (LBPs)



3. Calculate the histogram of LBPs features and assign it as template.

Repeat steps 1-3 for each particle in the current frame. Use particle locations as new ROI centres.

Compute the particle weights as the 2-Norm distance between the template and particles histograms.







(3.a) This is an example of the distances calculated in Point 3 for the dense grid in the current frame relative to the centre of the previous detection.

4. Use the particle weights to resample them to obtain a new set of particles with approximately equal weights.

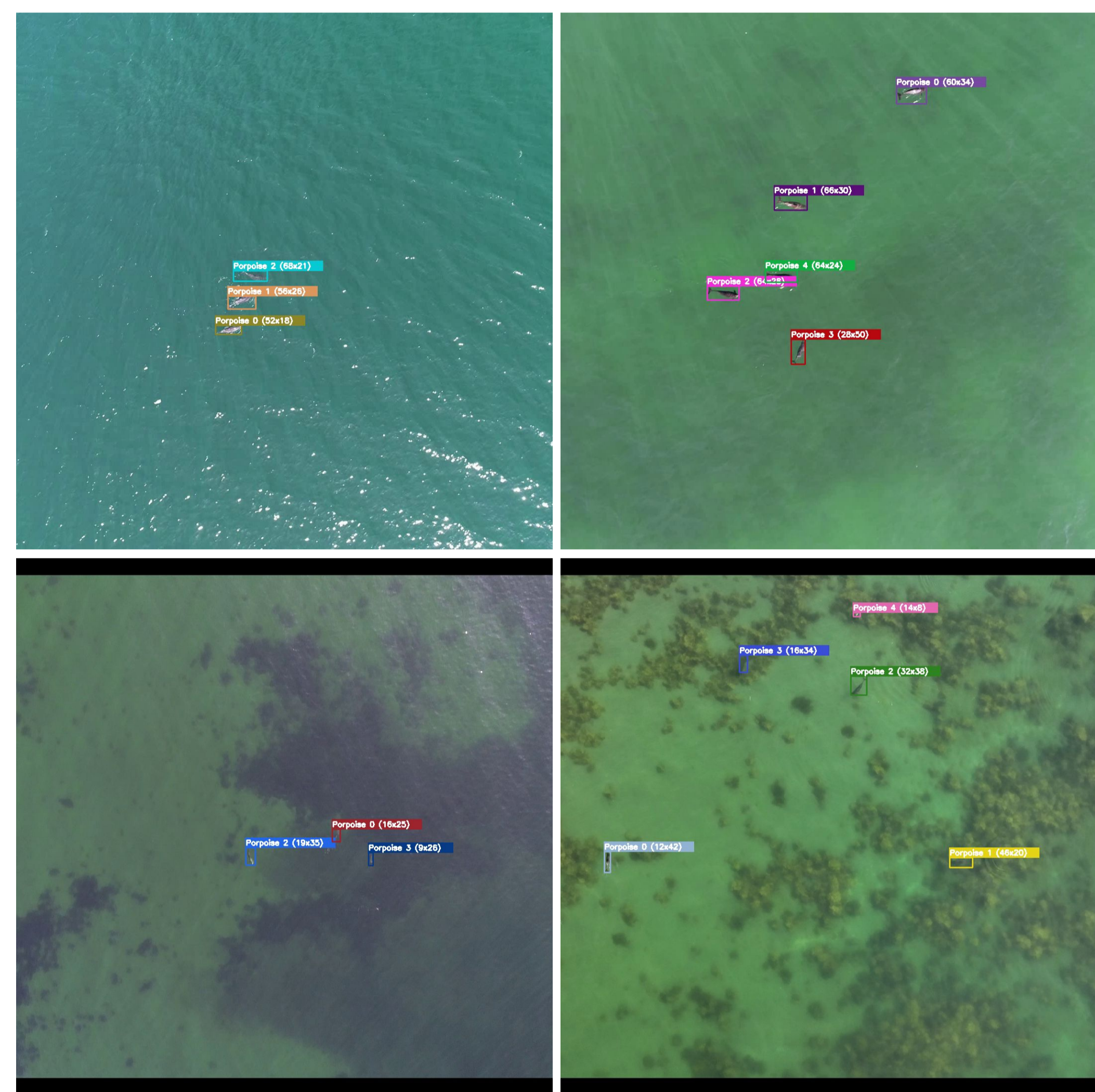
Add the gaussian noise to each particle's position, providing an exploration factor in the algorithm.

Assign new particles' positions and compute their average locations as a new object centre.

Dataset

-  92 video sequences of porpoises collected using drones
-  21'600 frames with the resolution of 1920 × 1080
-  233 hand-labelled porpoise trajectories
-  46'715 bounding boxes

Example video frames

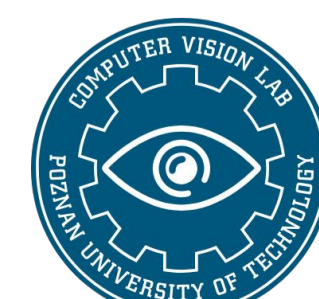


Results

Method	HOTA (↑)	ID-SW (↓)	ID-F1 (↑)
SORT	0.568	4.57	0.628
Strong-SORT	0.514	10.60	0.535
OC-SORT	0.526	3.40	0.597
BoT-SORT	0.604	4.40	0.650
SORT+PF (our)	<u>0.660</u>	<u>3.30</u>	<u>0.687</u>

Acknowledgments

This project has been supported by the Polish National Agency for Academic Exchange (NAWA) under the STER programme, Towards Internationalisation of Poznan University of Technology Doctoral School (2022-2024).



PUT Vision Laboratory
 vision.put.poznan.pl