Learning Fluid Flow Visualizations From In-Flight Images With Tufts

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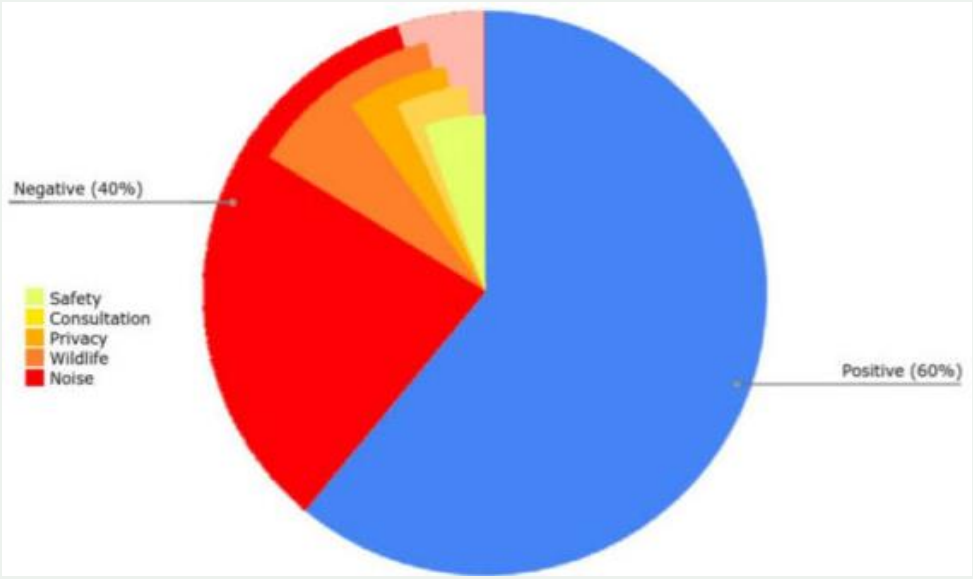
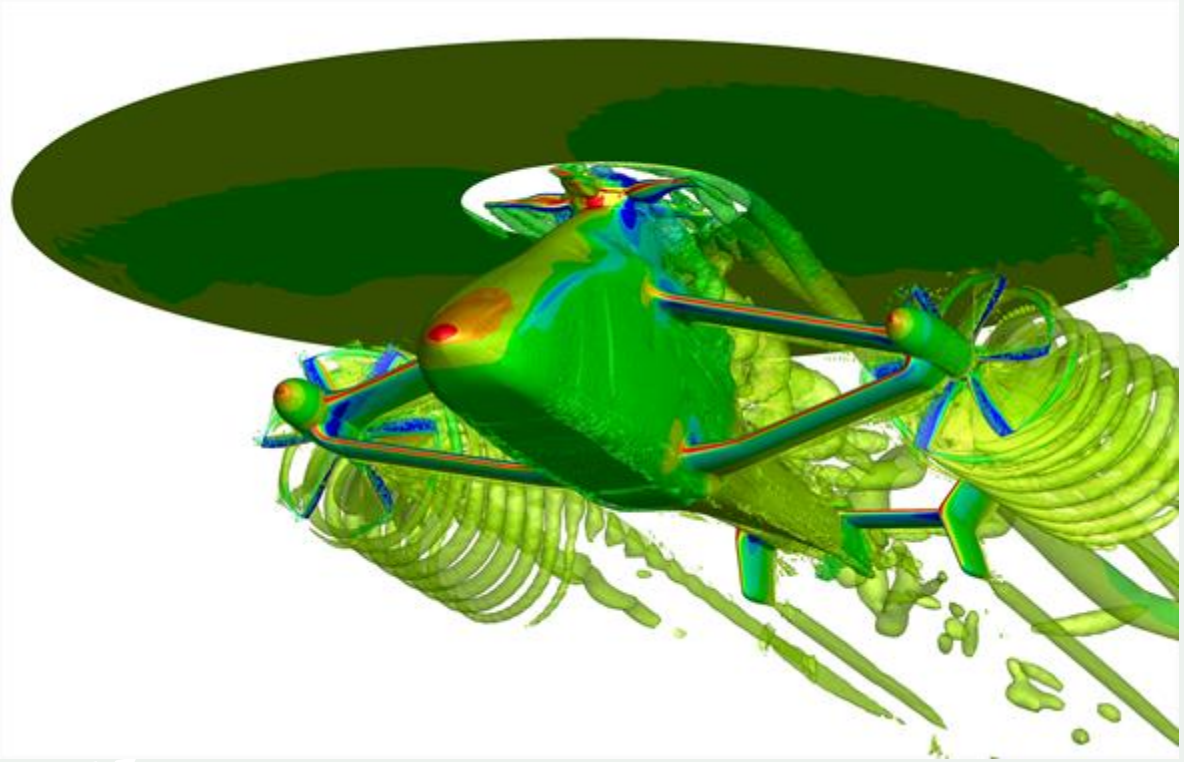
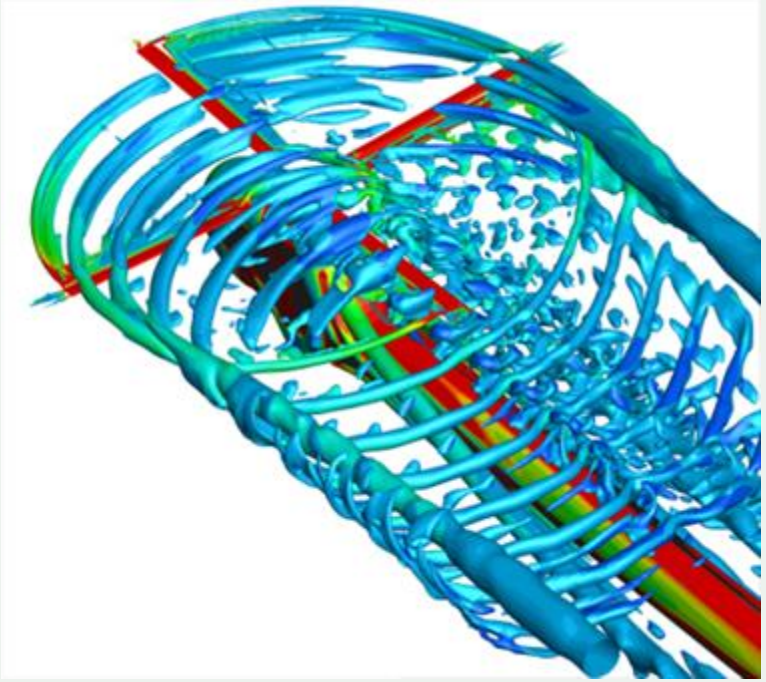
Why aerial robots are always so noisy?



A survey, carried out by the company Wing about user experiences of drone delivery.

Physics behind fluid flows and acoustics are complex

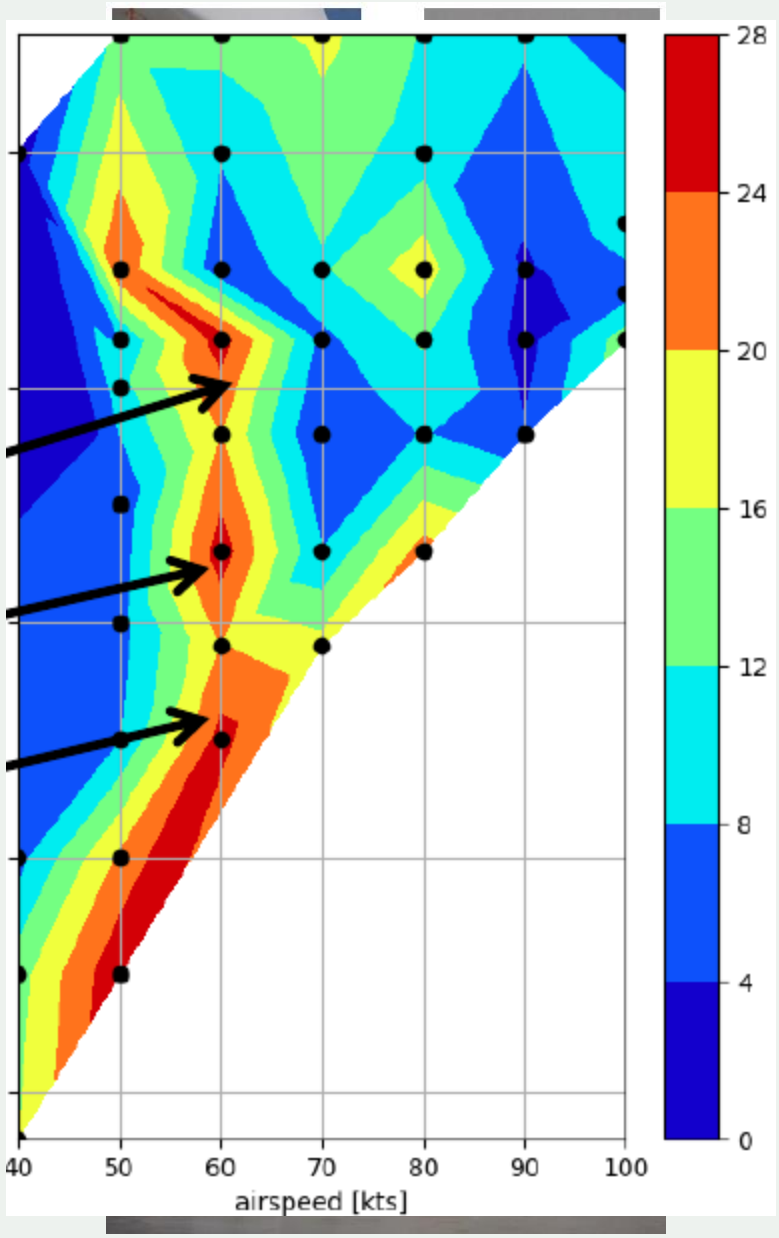




AI4Science

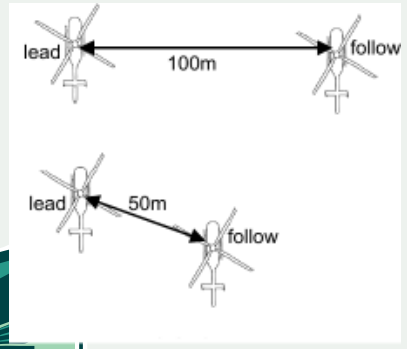
We learn in-flight fluid flow visualizations:

1. Install tufts and fly an aerial system.
2. Capture in-flight images.
3. Apply semantic segmentation on tufts.
4. Visualize flow topology over time.



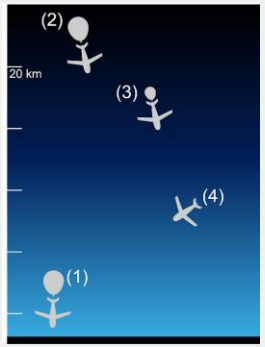
Contribution 1: Flight data

Data-set open sourced.



Aeroacoustics of helicopter flight:

- To analyze in-flight aerodynamic behavior of anti-torque device called Fenestron or fan-in-fan.
- Manned helicopter with 81 tufts.
- Images collected by another manned helicopter, flying in formation.

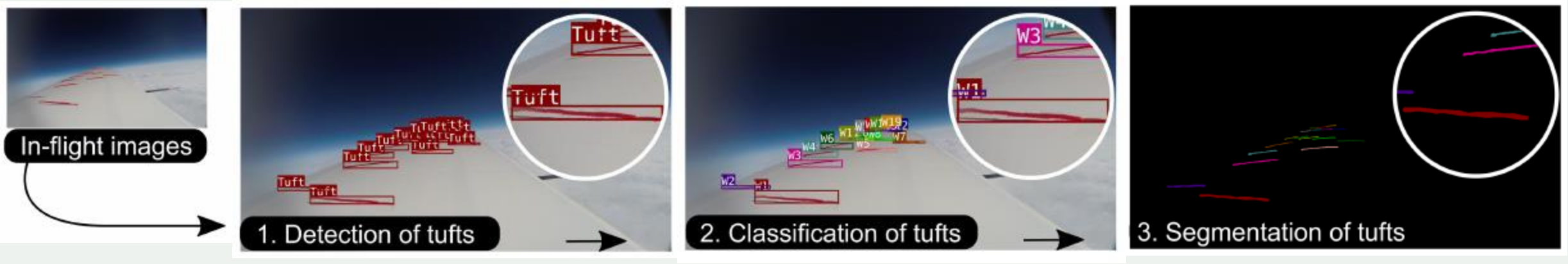


Stratospheric flight with UAVs:

- To analyze in-flight aerodynamic behavior in stratosphere, i.e., 20km altitude with less air density.
- Ballooned UAV glider with 19 tufts.
- Images collected by GoPro mounted.

The DLR HABLEG mission led by DLR Robotics Institute (Konstantin Kondak) in 2015.

Contribution 2: Probabilistic methods



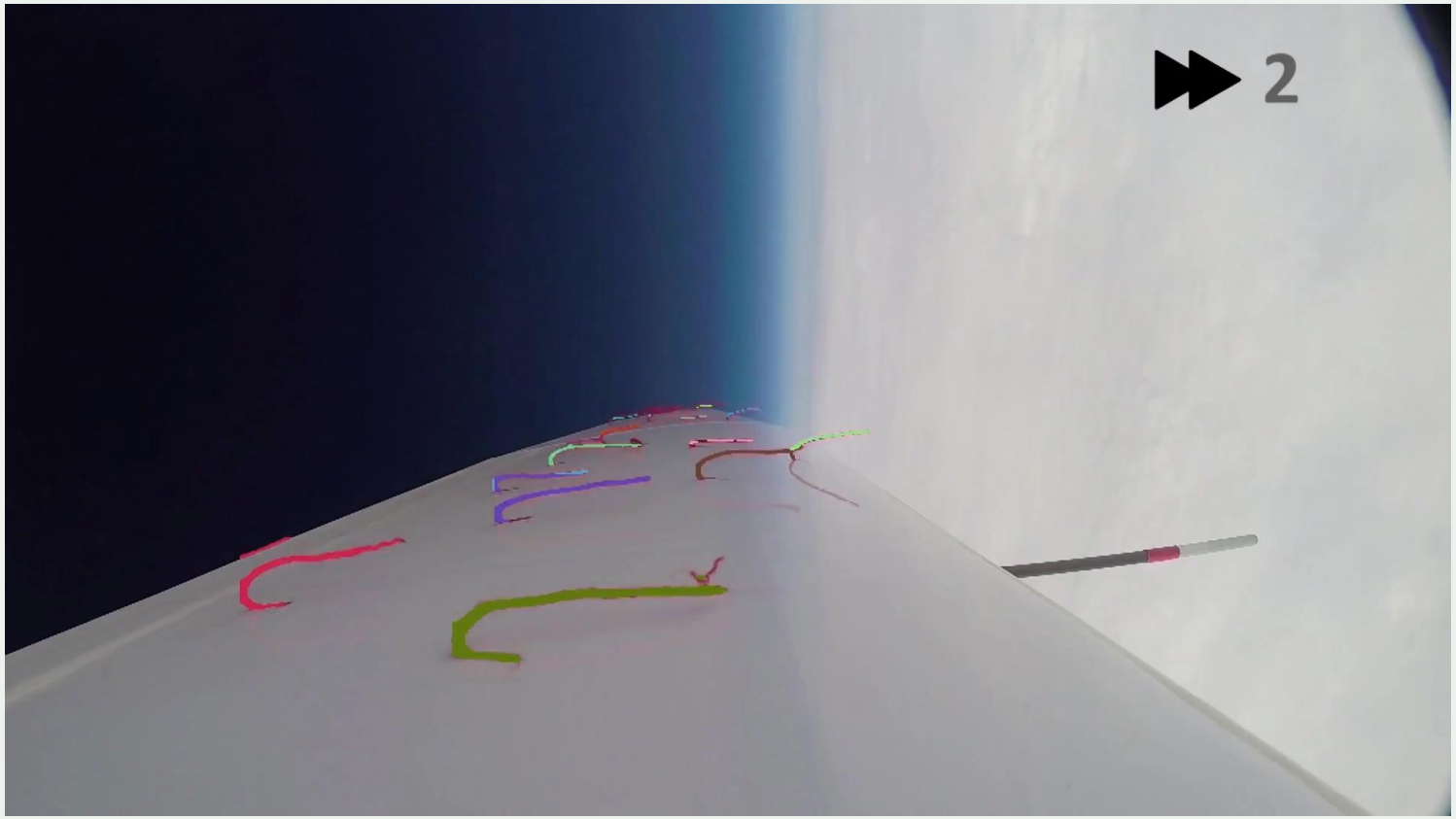
Active learning with coarsely annotated data. Based on uncertainty sampling.

Combine uncertainty estimates, image matching and Hungarian algorithms to propagate labels.

Weakly supervised segmentation with so-called uncertainty maps.

Shows how probabilistic approaches facilitate the learning process without requiring any manual annotations of semantic segmentation masks.

Contribution 3: A working demo at scale



Thank you for listening.

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