

# Automated Early Detection of Wildfires with UAVs in Regions of Weak Telecommunication

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- Automated UAV systems could replace fire control flights
- In remote areas poor telecommunication forces computation to be done onboard
- With onboard segmentation and location triangulation the communication can be limited to geolocation information

## Segmentation

Model	N. params	GFLOPs	FPS
PIDNet-S	7.72M	49.7	25.88
PIDNet-M	28.8M	182.9	9.86
PIDNet-L	37.3M	284.3	7.47

**Table 1.** Model sizes and inference frame rates with the onboard computer.

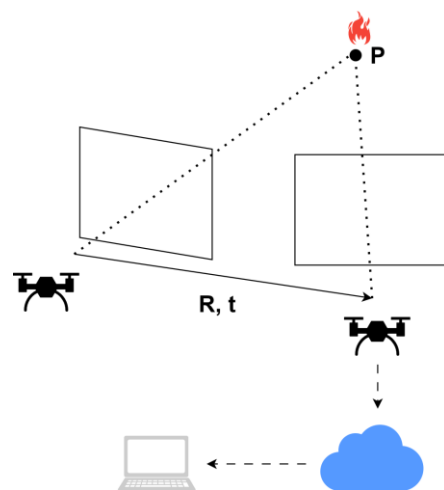
- The frame rates were computed with an NVIDIA Jetson Orin NX that can be easily carried by small UAVs
- The models were trained with bounding box annotated data and SAM [1,2]
- Real world tests, shown on the right, were conducted at prescribed burning events in Komio from up to 9.7 km

## Triangulation

- Enables wildfire localization based on the segmentation model output and UAV movement
- Challenges arise from noise in detection model outputs and camera pose estimation

## References

- [1] Julius Pesonen, Teemu Hakala, Väinö Karjalainen, Niko Koivumäki, Lauri Markelin, Anna-Maria Raita-Hakola, Juha Suomalainen, Ilkka Pölonen, and Eija Honkavaara. Detecting Wildfires on UAVs with Real-time Segmentation Trained by Larger Teacher Models. arXiv preprint arXiv:2408.10843, 2024.
- [2] Alexander Kirillov, Eric Mintun, Nikhila Ravi, Hanzi Mao, Chloe Rolland, Laura Gustafson, Tete Xiao, Spencer Whitehead, Alexander C Berg, Wan-Yen Lo, et al. Segment anything. In Proceedings of the IEEE/CVF International Conference on Computer Vision, pages 4015–4026, 2023.



**Figure 1.** Illustration of the full application.

