



# Increasing situational awareness for mission critical tasks: Synthetic RGB and Thermal images for robust vision AI models

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Ascent Lumina  
CEO  
**Kriss Osmanis**

2025 March



✓ Top 10 winner in  
**NATO Innovation Hackathon**  
**“AI/ML for sensor fusion, reconnaissance, and command and control (C2)”**  
on March 11-18, 2025.



Training detector vision AI model requires large number of images (10000+ images in training data set), with:

- **Targets to detect**
- **Circumstances to be detected in, inc. poor visibility.**
- Preferable taken with same camera (e.g. field of view, lens warp)
- Targets labeled with bounding box.

# Synthetic data generation

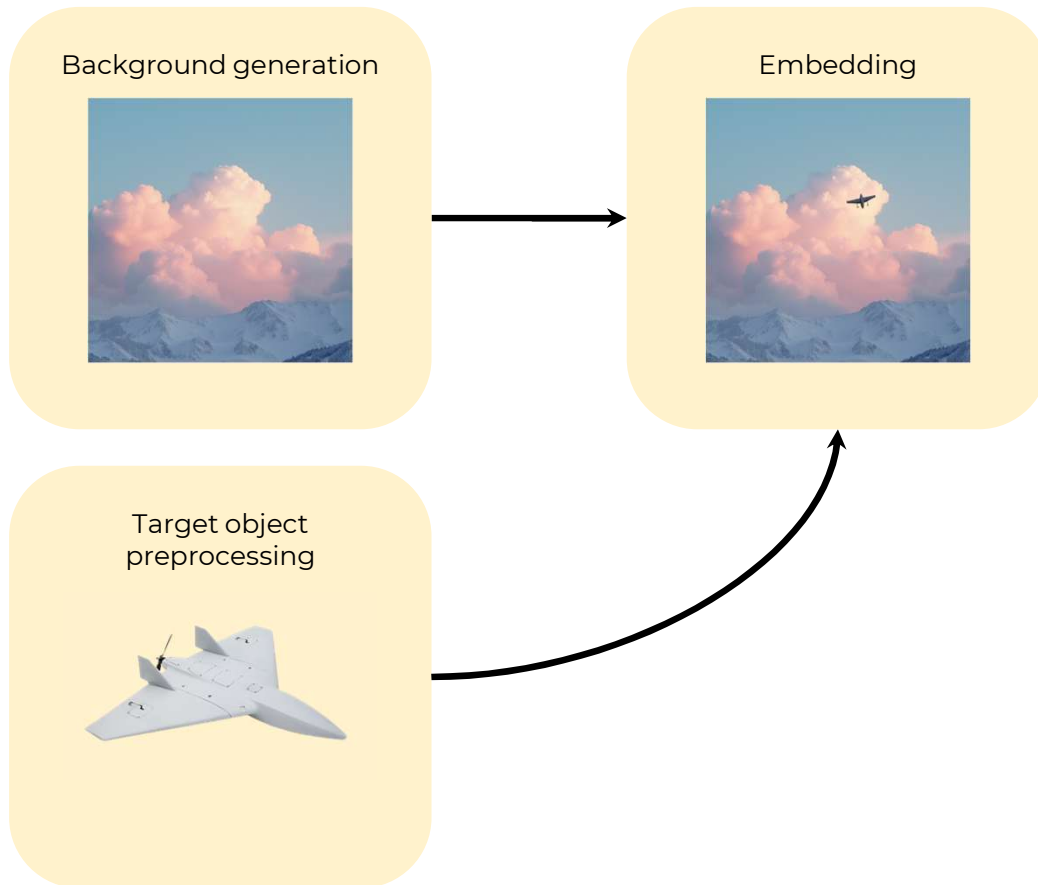
Background generation



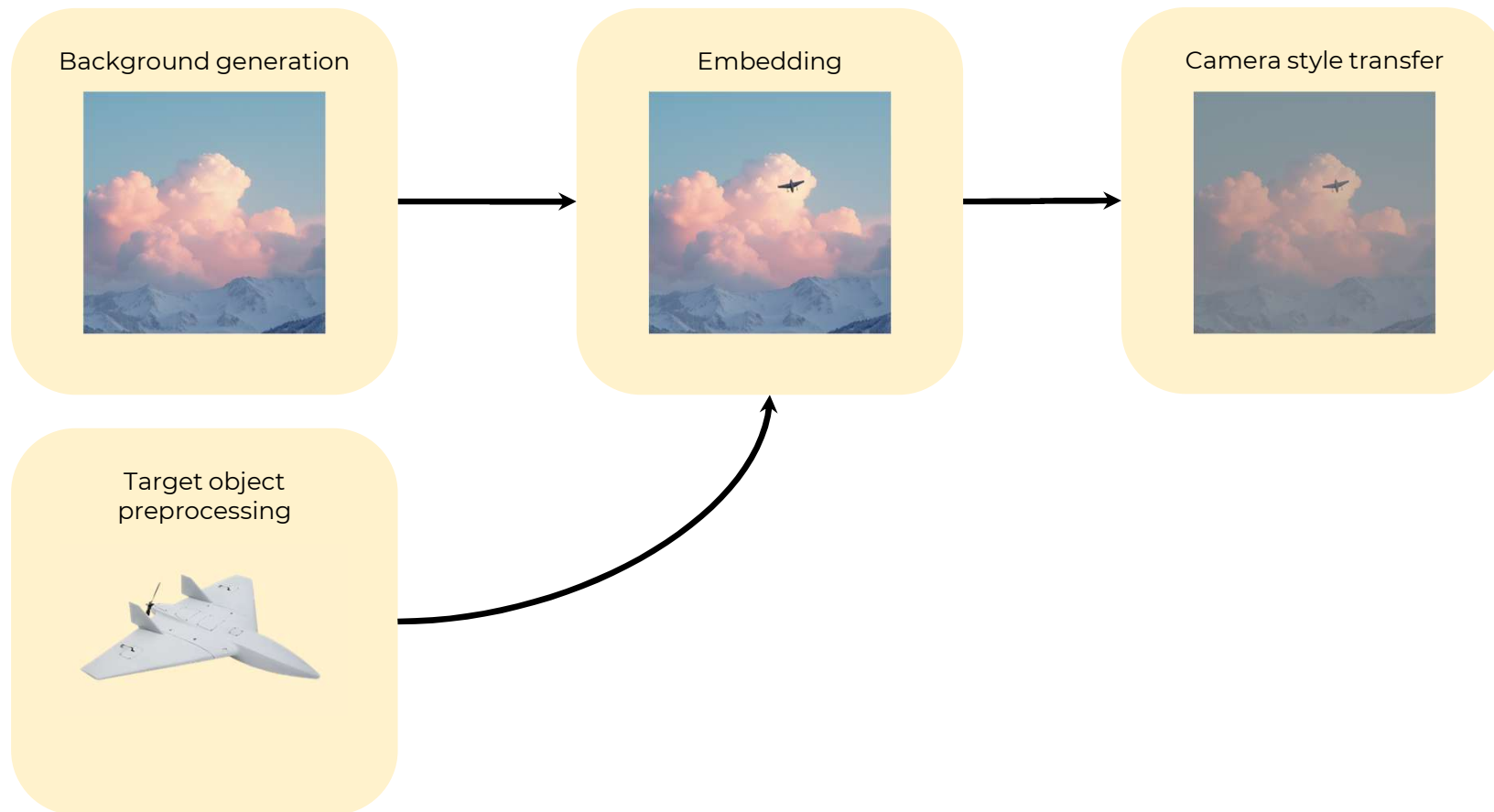
Target object  
preprocessing



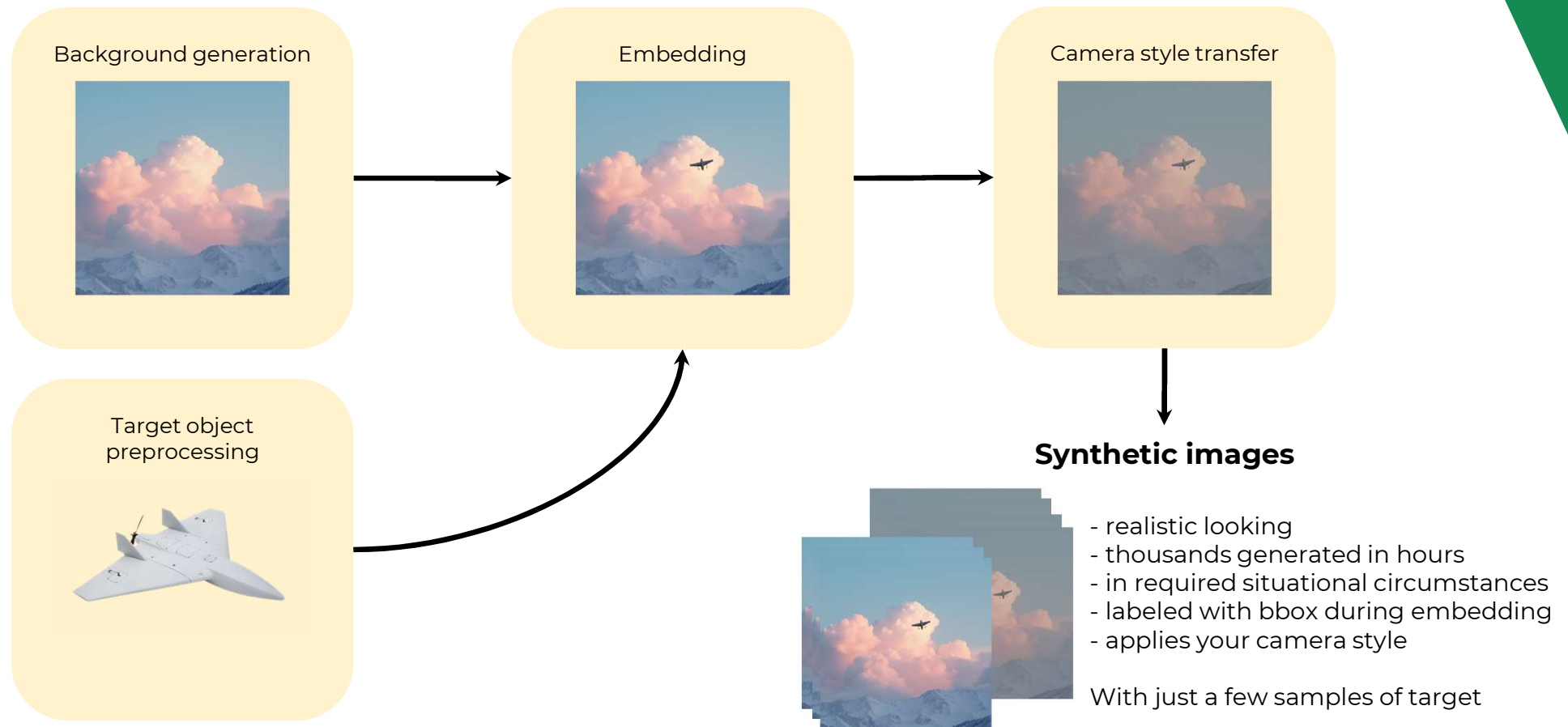
# Synthetic data generation



# Synthetic data generation



# Synthetic data generation



# Synthetic vision data generation

## Examples of control capability



Object size,  
placement,  
rotation



Environment,  
seasons



Horizon  
proportions



Lighting,  
sun position

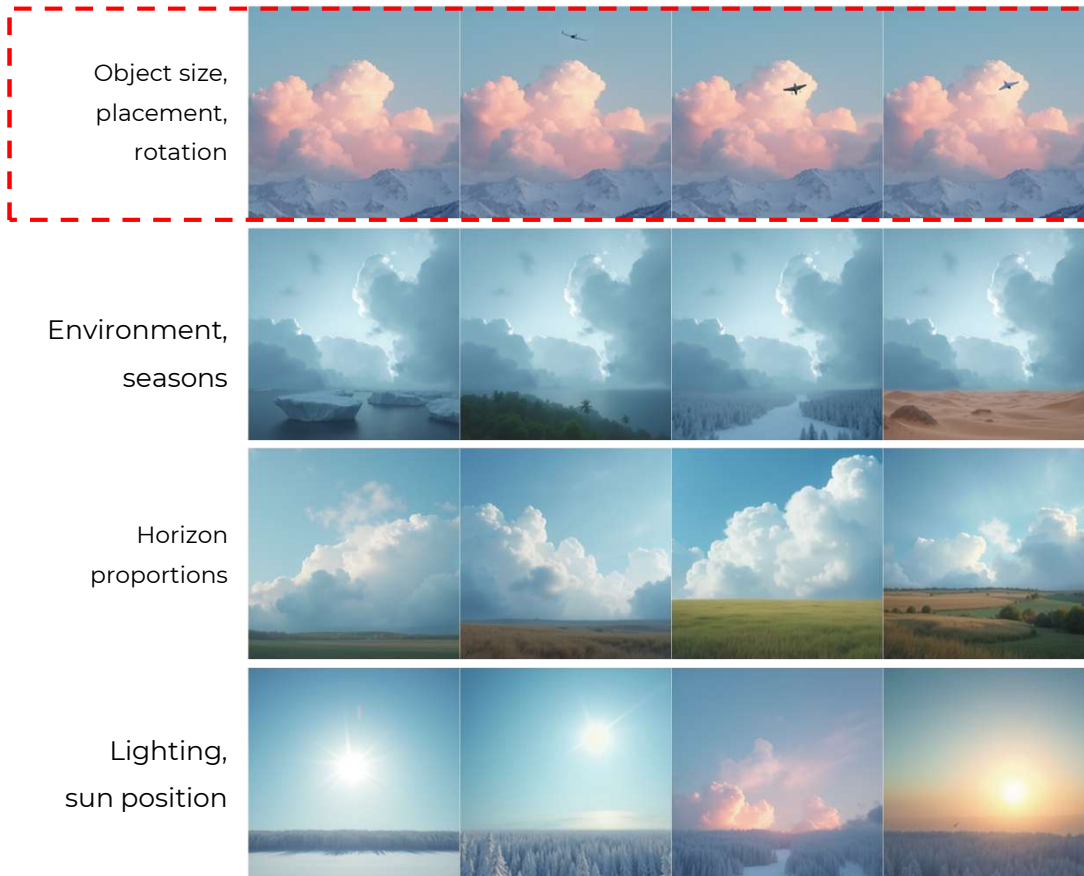


Camera style

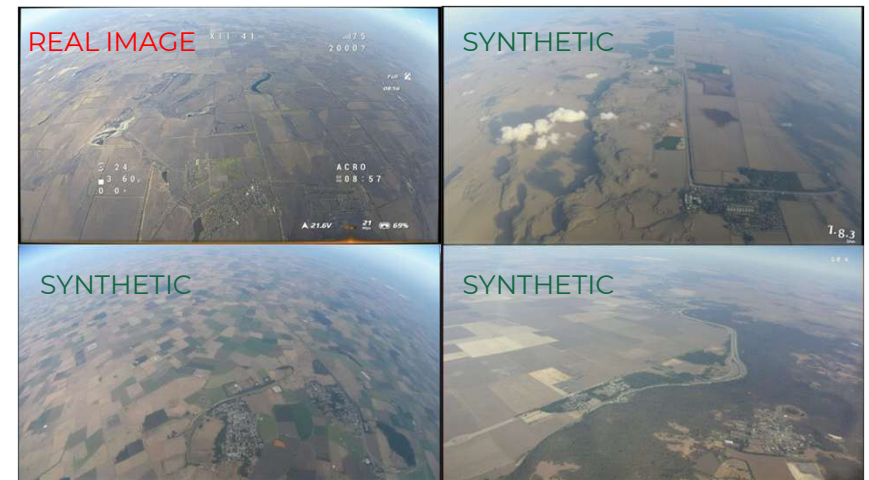


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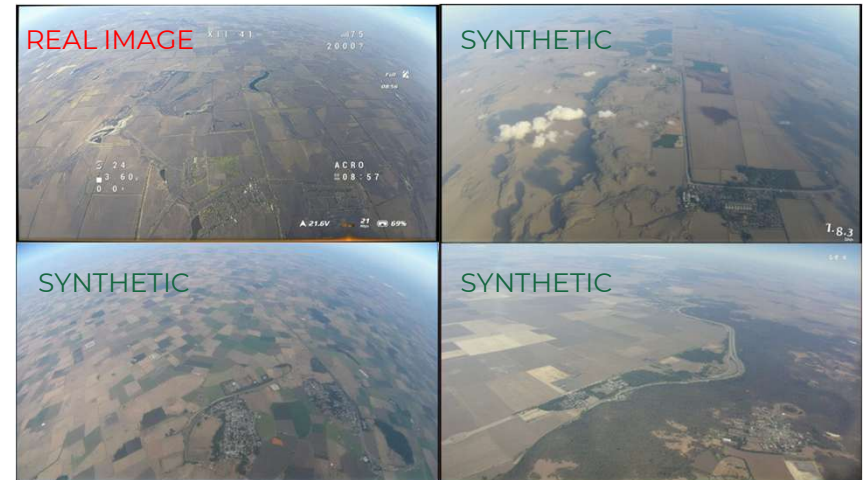
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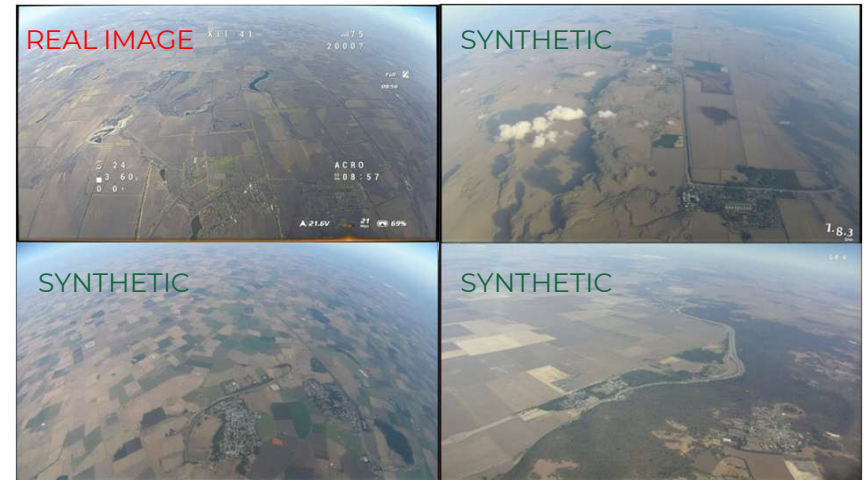
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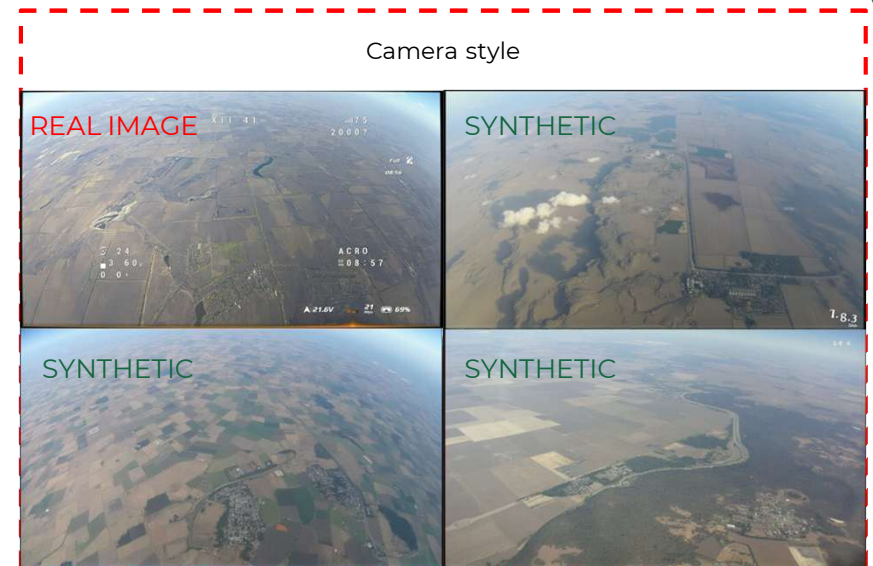
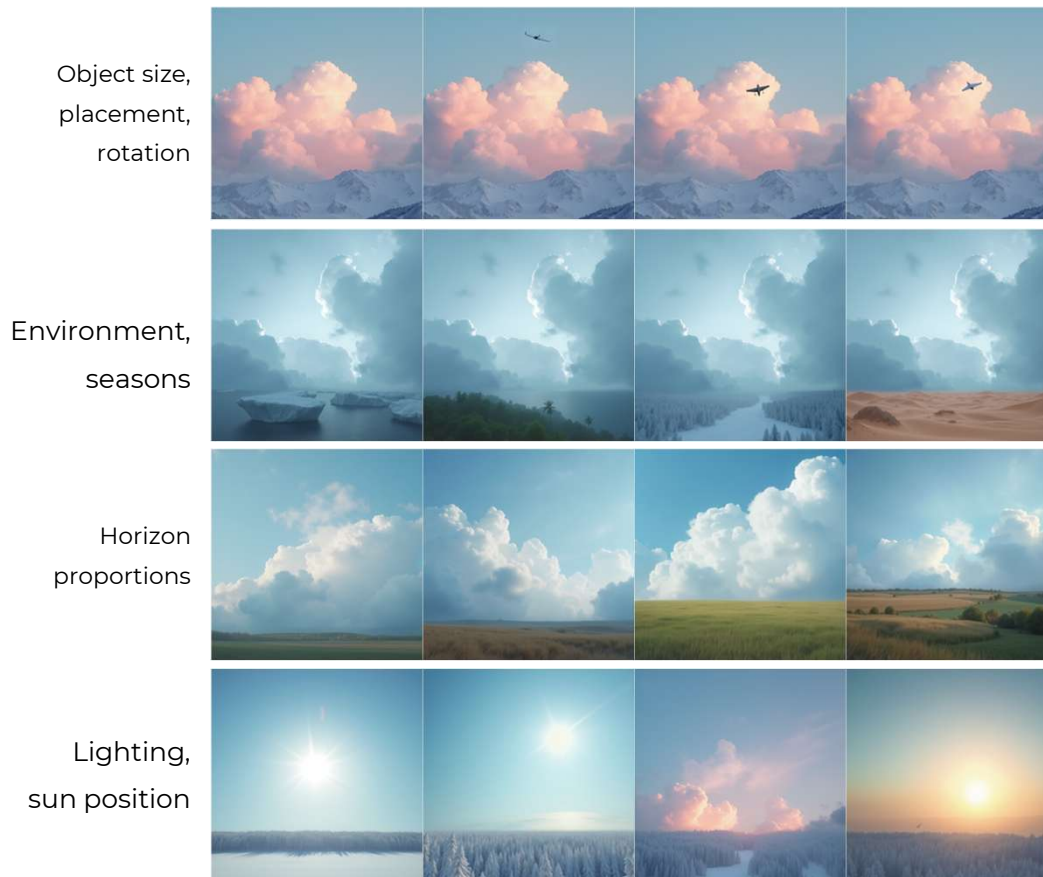


Camera style



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## Examples of control capability



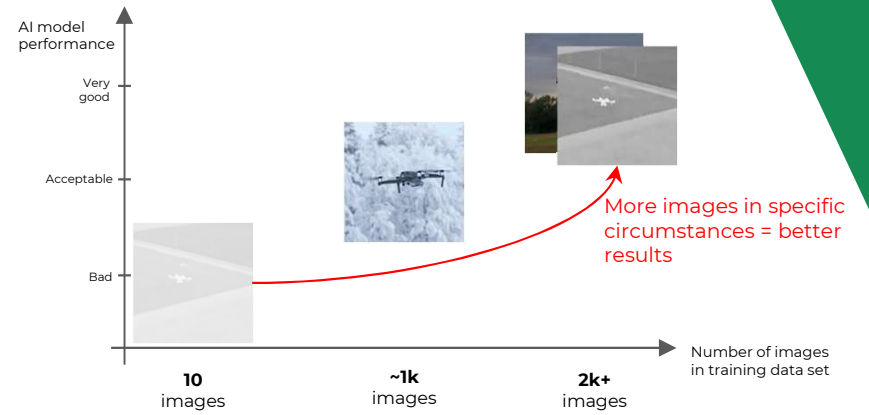
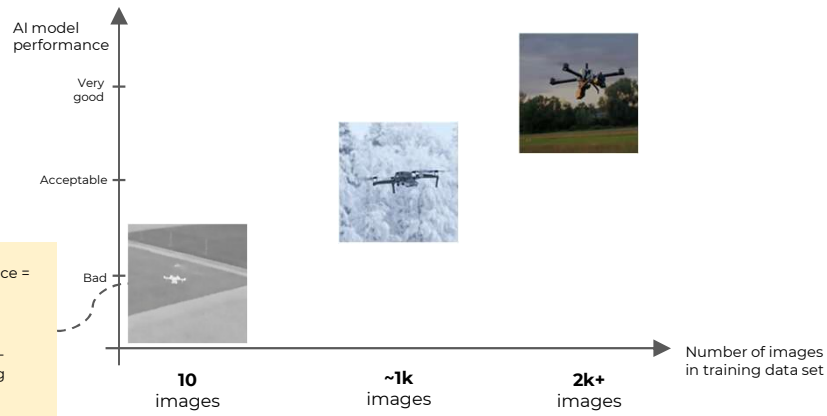
# Synthetic vision data generation IR and Thermal



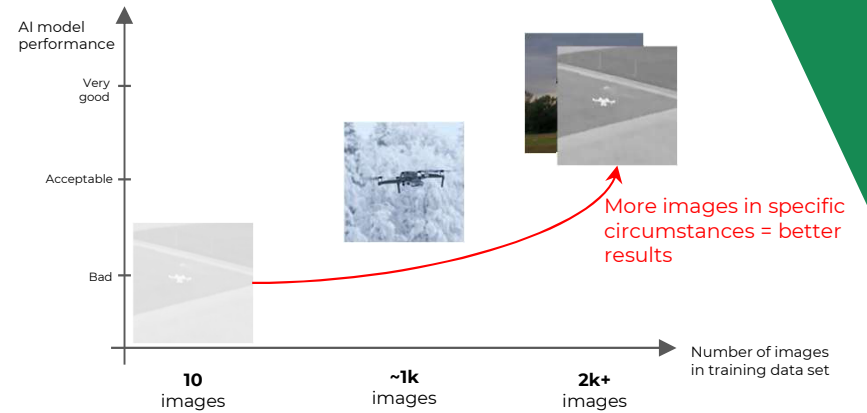
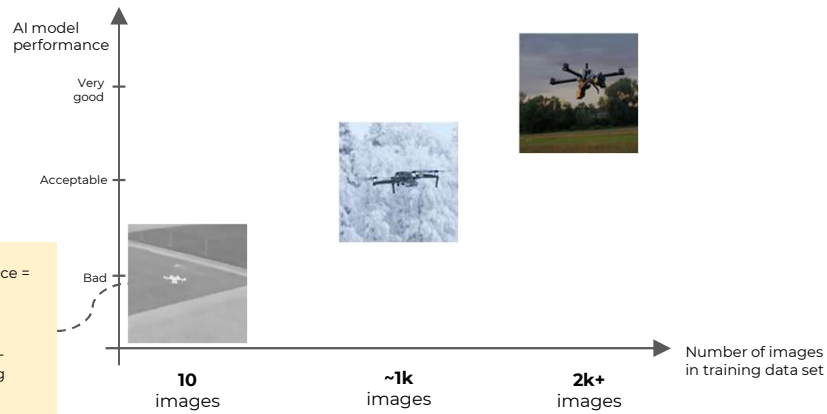
SAMPLES OF GENERATED SYNTHETIC IMAGES



# Value of synthetic images



# Value of synthetic images



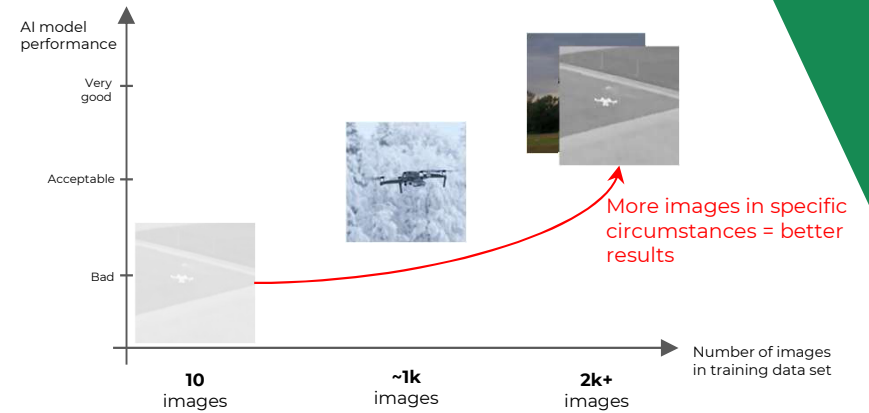
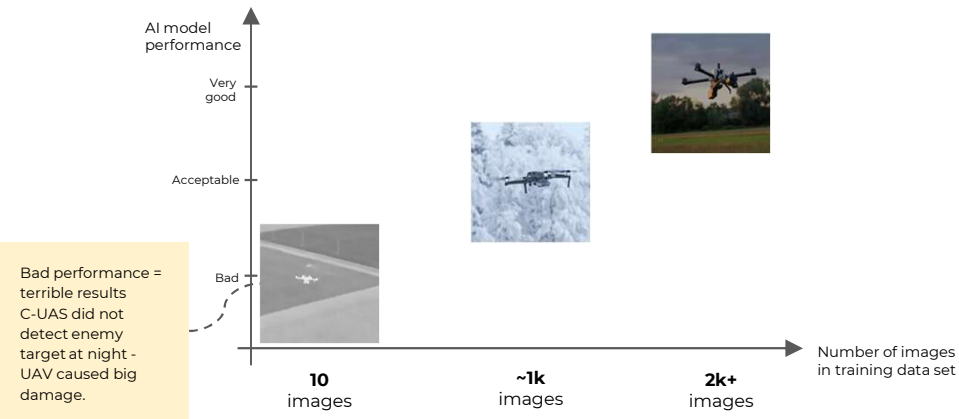
## Increase model performance

Support RGB and Thermal vision.

Considerable increase if real images are very limited

Moderate increase if supplementing real image data set for specific conditions.

# Value of synthetic images



## Increase model performance

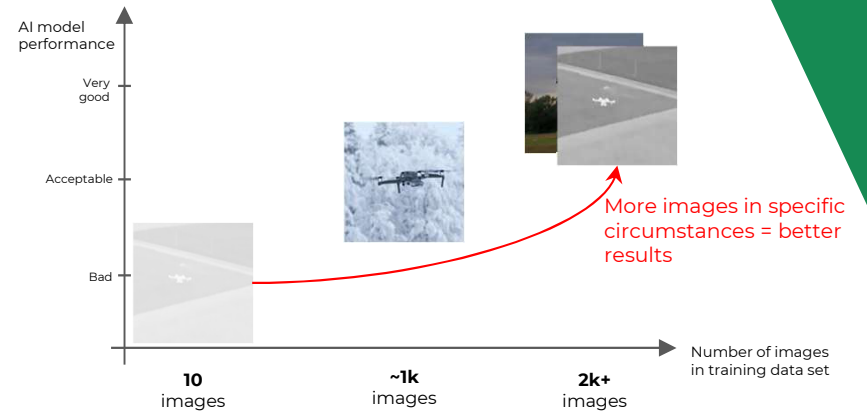
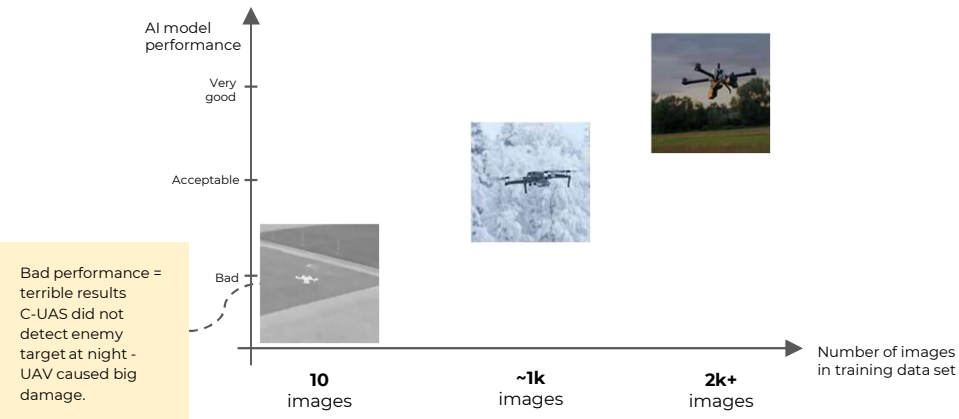
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## New target and environment support

Enable new target detection in new circumstances **in a matter of hours**, with just a few sample images of the new target and circumstances.



# Value of synthetic images



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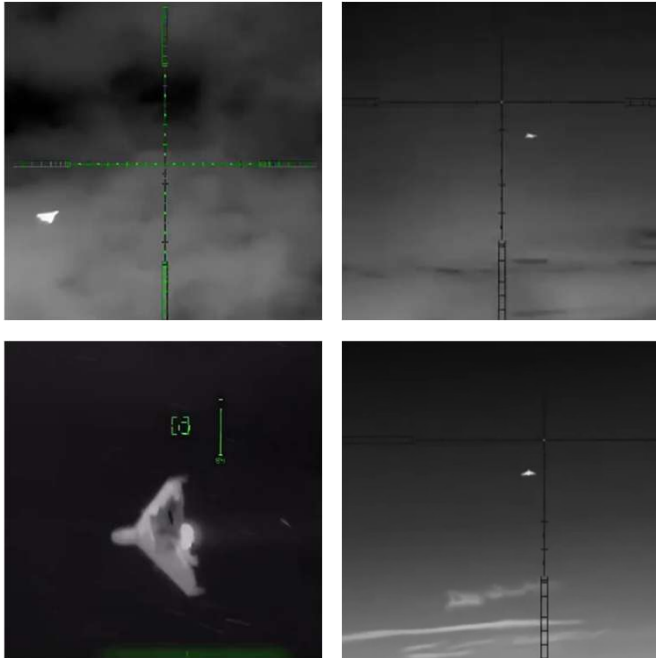
## SWaP-C optimization

Optimize SWaP-C by specializing vision AI models for specific tasks.  
Enabled by generating dataset for specific circumstances and targets.

# NATO Innovation Hackahton (11.03-18.03) IR and Thermal support



4 REFERENCE IMAGES (from Twitter video)



SAMPLES OF GENERATED SYNTHETIC IMAGES

Example dataset 2k images in matter of hours



# NATO Innovation Hackathon IR detector demo



## Specialized lightweight AI vision models



Specialize model by using synthetic image data sets



**Save data acquisition time**, e.g. detector for a new kind of UAV implemented in few hours, instead of weeks / months.



Model optimization for real time  
(e.g. NVIDIA Jetson Orin Nano, NXP iMX8)



**Save you hardware costs** and power, can be deployed in unmanned vehicles.



Computer vision processing - thermal vision processing, overlaying, object detection, target locking



Go beyond vision AI models for efficient deployment of conventional vision processing



Edge device example for AI vision deployment  
(NVIDIA Jetson Orin Nano)

## Lightweight AI vision models

### Case example

- Custom object detector - on NVIDIA Jetson Orin Nano
- Trained on synthetic data from 5 sec example video
- Combined with target locking/following
- Achieved 30-60 fps
- Built for Riga Technical University drone autonomy project



# Summary



Dual use technology company, developing situational awareness solutions for uncrewed vehicles and pilots



Experts in computer vision, AI models, synthetic image generation and sensor fusion to enhance situational awareness, effective target detection and classification on edge devices



SME, located in Riga, Latvia, founded in 2023 by two Dr.sc.ing's in electronics and computer vision engineering with excellent understanding of building complex tech systems



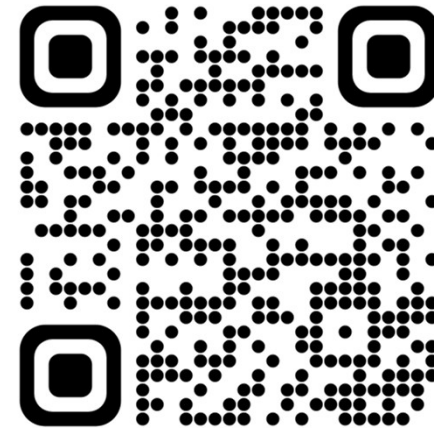
Own synthetic image generation pipeline enables AI vision model optimization for the task





ASCENT LUMINA

*Making heroes into  
superheroes.*



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