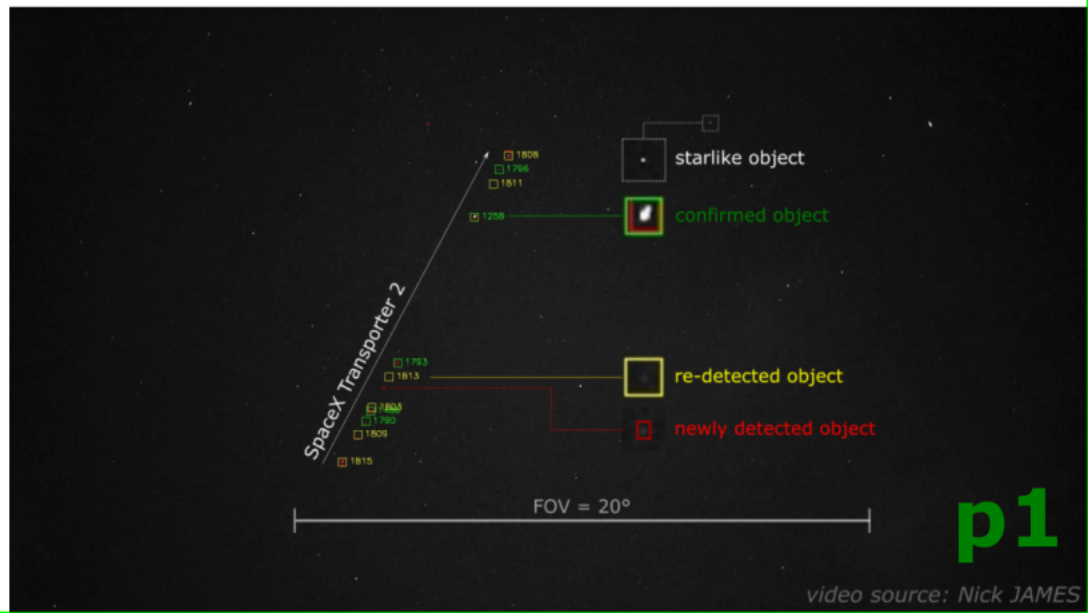
Machine Learning User Group Stuttgart (#mlugs im Mai 2022)

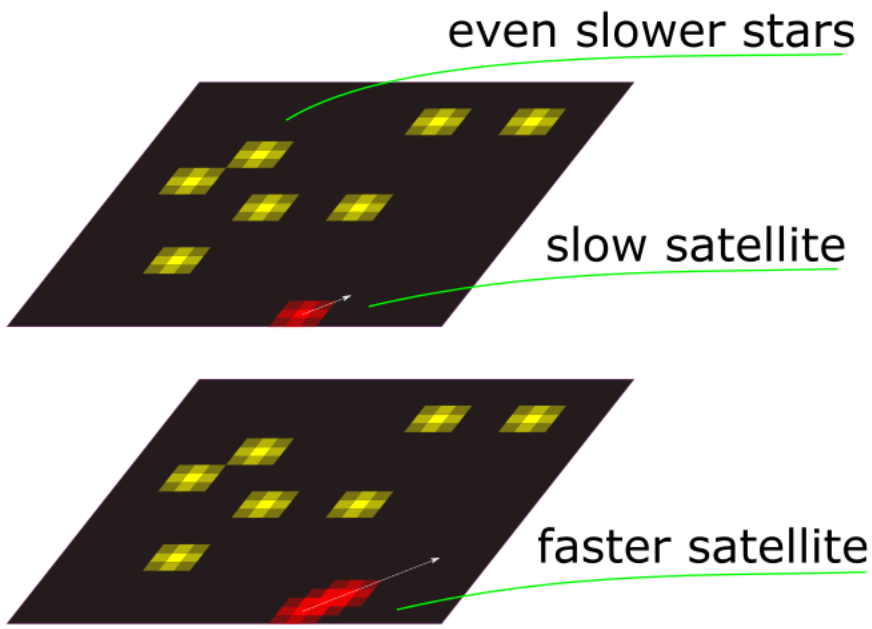
Wird‘s klappen? Satelliten am Nachthimmel simulieren als ML-Training

* Ich bin (auch ein) Andreas (Twitter: @AndreasHornig)
* Ich bin Luft- & Raumfahrt Ingenieur (AerospaceResearch.net)
* Ich lerne ML und mache mit dem anderen Andreas (MFA) den MLUGS / Makerspace Esslingen Workshop am 2022-06-07
* Wir wollen Satelliten in Videos von Sony Alpha A7S(i) finden
* **Dazu habe ich eine Simulation des Nachthimmels erstellt.....**
* Mal schauen, ob es klappt! :)

Video: https://youtu.be/jV9u9WspsI4

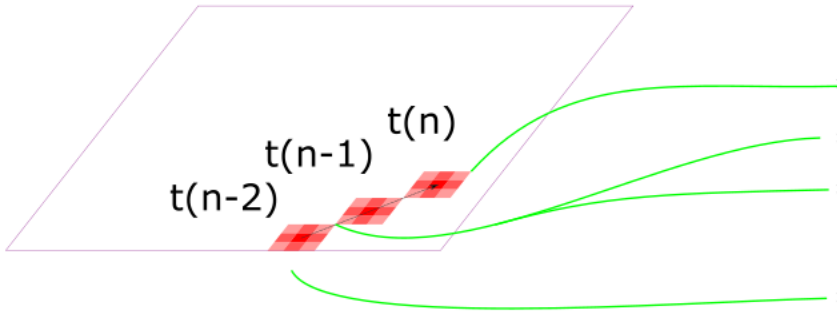


Basics: how to distinguish between stars and satellites?



Same brightness distribution like stars.
We can call that "star-like" objects.
In general nxn gaussian distributions of brightness.
Here all are 3x3 kernels (red and yellow)

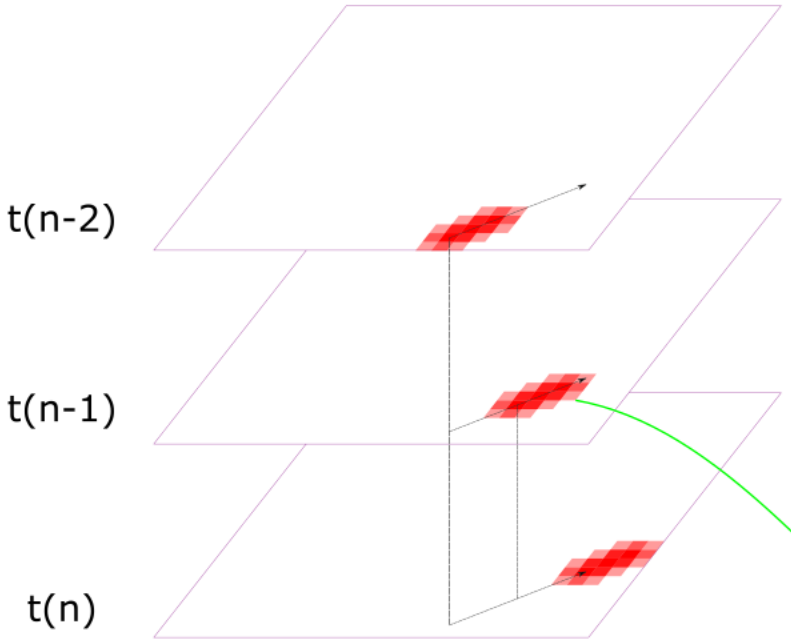
What we did: simulating the night sky by satellite moving on tracks



Generator that creates star like objects and changes:

* size of n in nxn
* direction as vector
* speed as in pixels per seconds
* as single satellite or starlink train of m satellites on some track
* time of entering into the frame

Interpolation of satellite brightness



For each frame, the nxn satellite is moved to its position.

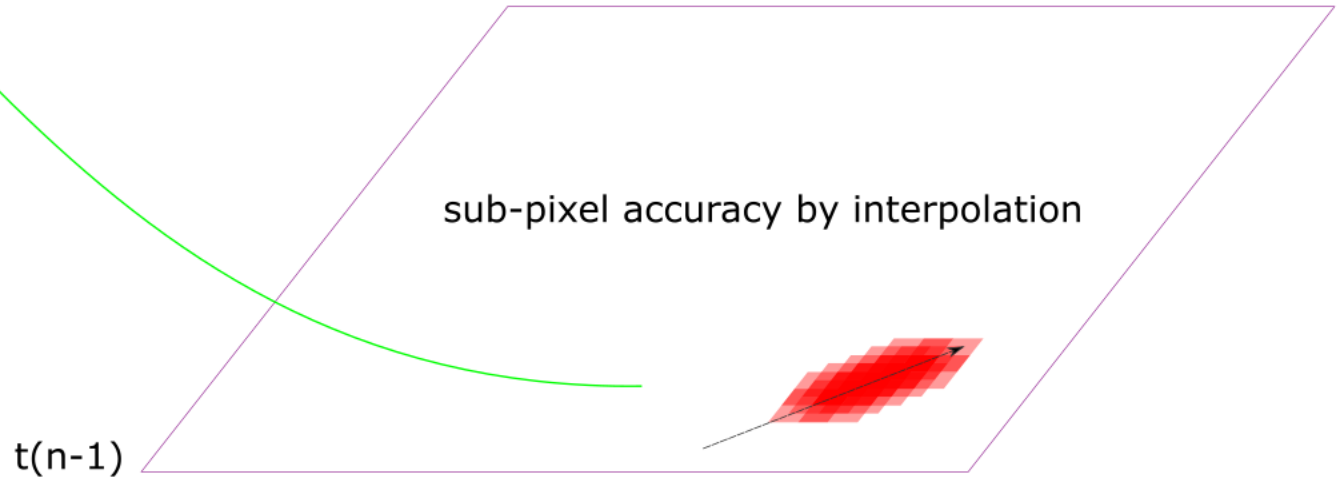
Depending on the speed this can result in "jumps".

The "integration time" of the camera is modeled.

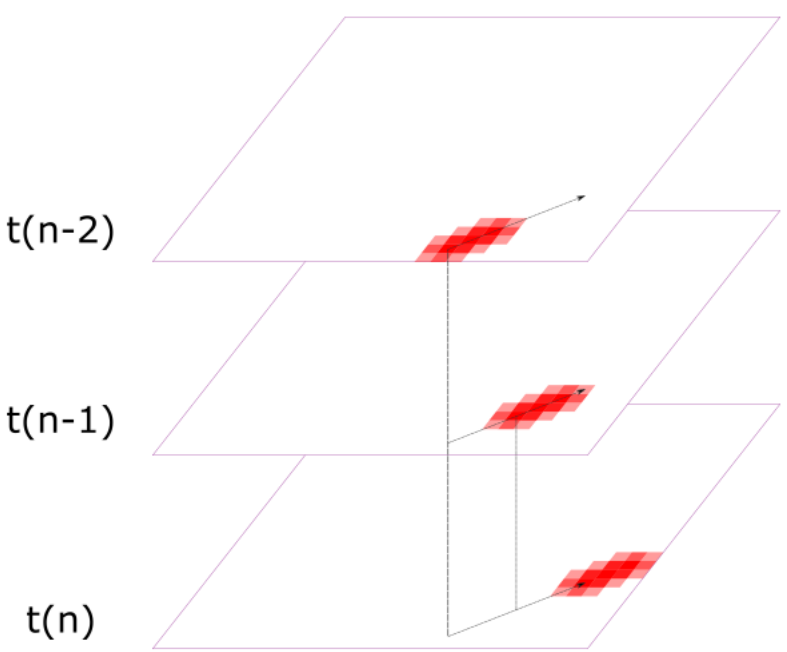
Each frame has subframes where kernel is moved ...

... and then combined to the final frame.

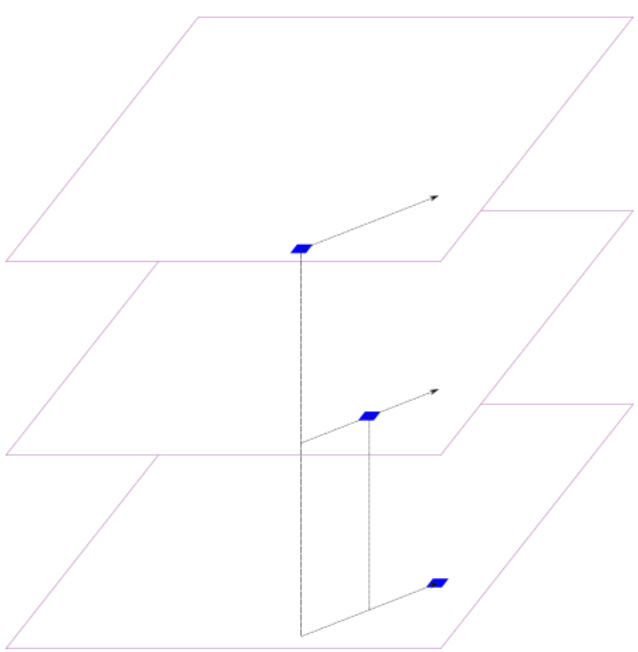
Also, each nxn kernel can be scalled up for better anti-aliasing.



Our knowledge of the satellites for training



n images
of simulated night sky



n track points of satellites
in simulated night sky

both two sets
of generated data

Combining satellite with noisy sky

satellite brightness at t(n-1)

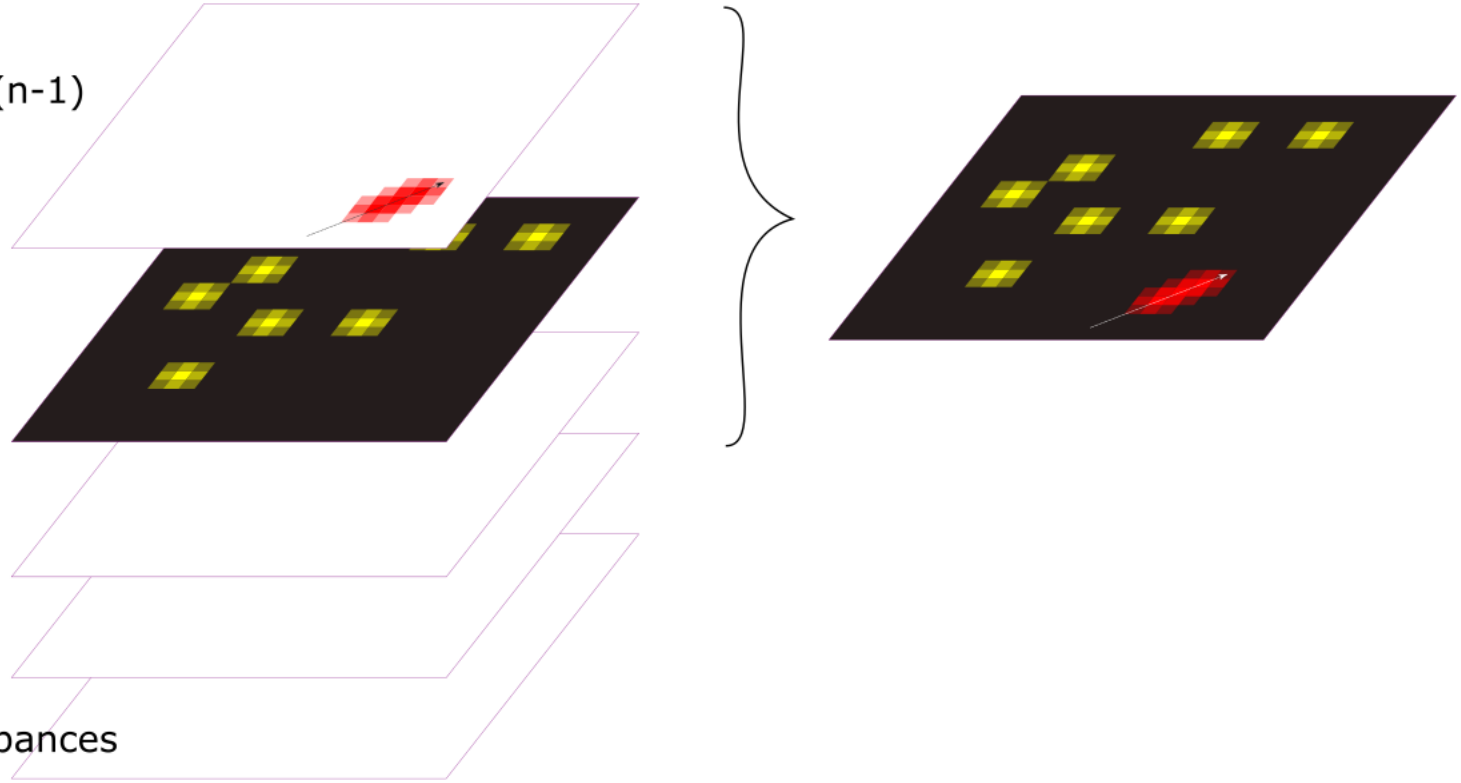
night sky background

* stars

* noise

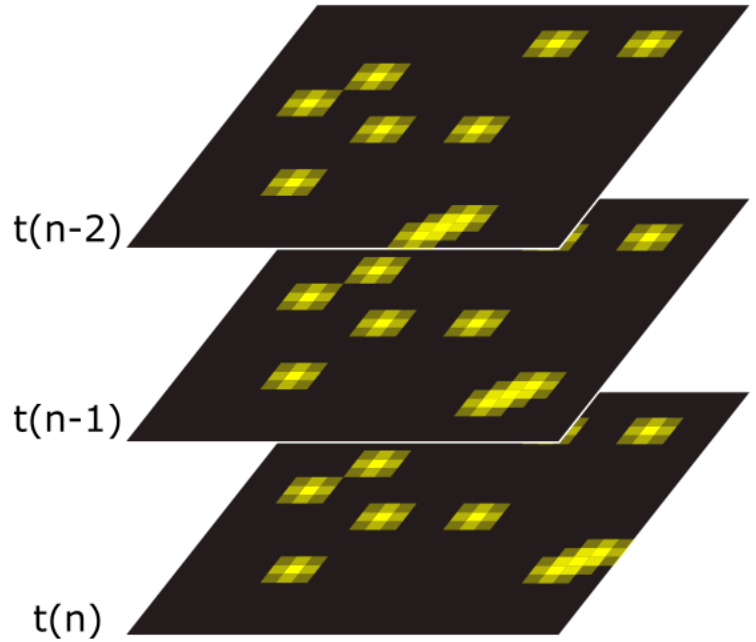
* clouds

* other disturbances

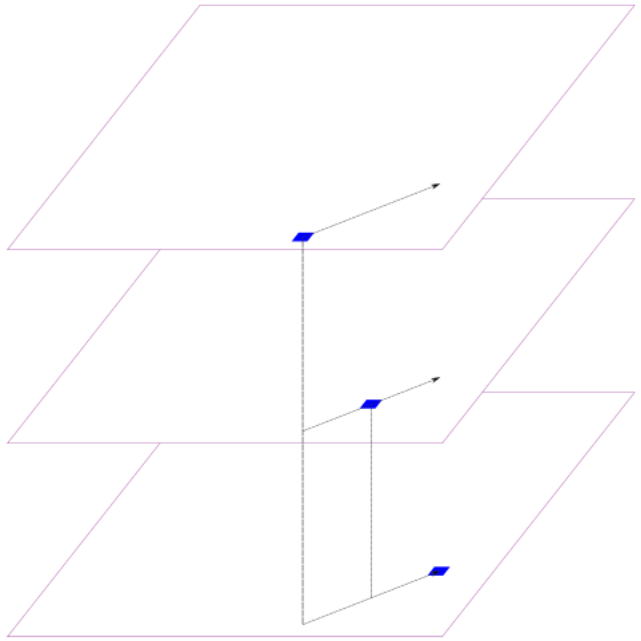


This is the end.....result for now

n images
of simulated night sky



n track points of satellites
in simulated night sky



2 data sets for training