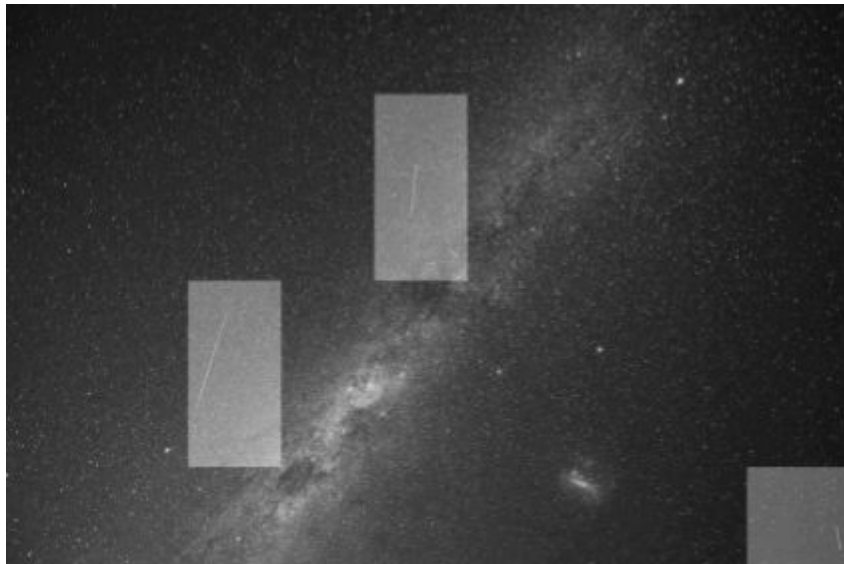# 🔊DISCUSSION ML/DL when there is little data

Aim
Detect transient objects - Meteors, Satellites, Aircraft in the nigh sky

Data

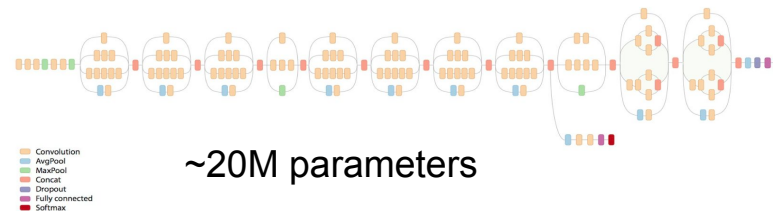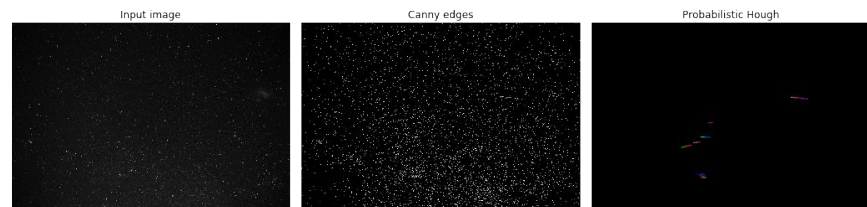~3500 images without meteors
~70 images with meteors

Solution

🔊 DISCUSSION ML/DL when there is little data

- Image processing
  - Edge detection
  - Line detection (Huff transform)
  - Despeckle

- Multi-Layer Perception neural net
  - Many false positives

- Transfer learning
  - Google Inception V3
  - 2015 ImageNet winner

- Proposed CNN model

Input image   Canny edges   Probabilistic Hough

Convolution
AvgPool
MaxPool
Concat
Dropout
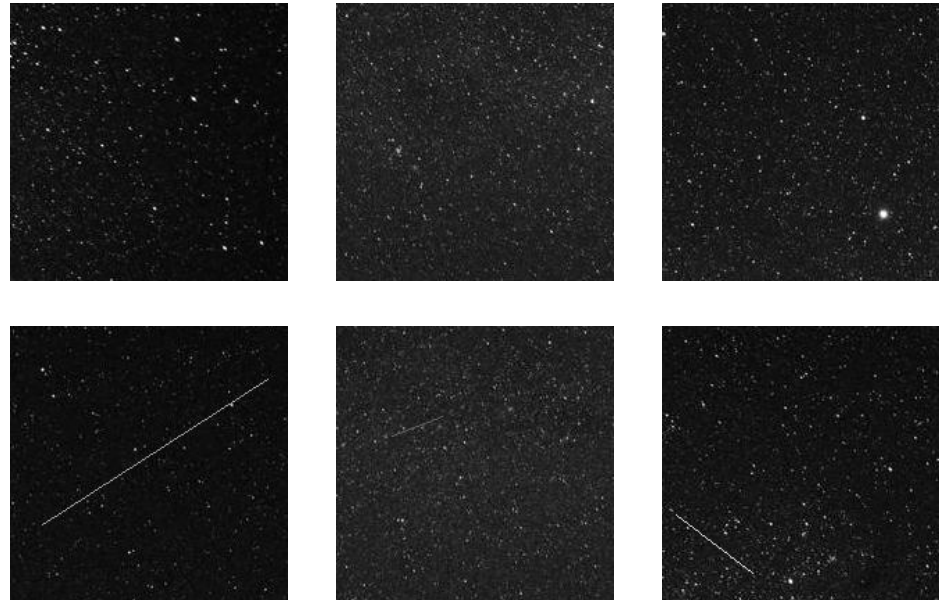Fully connected
Softmax

~20M parameters

🔊DISCUSSION ML/DL when there is little data

- 50 mobile bg images
- Dataset
  - 40,000 images (50% meteor)
  - 200x200 tiles
  - Variation
    - Background
    - Size (length and width)
    - Brightness
- Tuning
  - Faint meteors
  - Bright and crowded backgrounds
- Preprocessing
  - Resize to 25% (7360 x 4912 -> 1840 x 1228)
  - Grayscale

ML/DL when there is little data

Classification thresholds

Threshold	Predictions
90%	316 (100%)
85%	325 (100%)
80%	334 (100%)
75%	337 (100%)
70%	349 (100%)
65%	349 (100%)
60%	351 (100%)
55%	355 (100%)
50%	358 (100%)
40%	369 / 376 (98.1%)

Final results

Camera	Predictions
mobile	358 (100%)
station	107 (100%)

🔊DISCUSSION Methods in ML

- Points to ponder:
  - Using fp16 or even int8 and performance gains
  - Multi-GPU training
  - Reproducibility
- Synthetic Data (**Ex. 5. Detecting meteors)**
- **Dissecting convolutions**
- YOLO3
- AutoKeras
- Transfer learning
- Unsupervised learning