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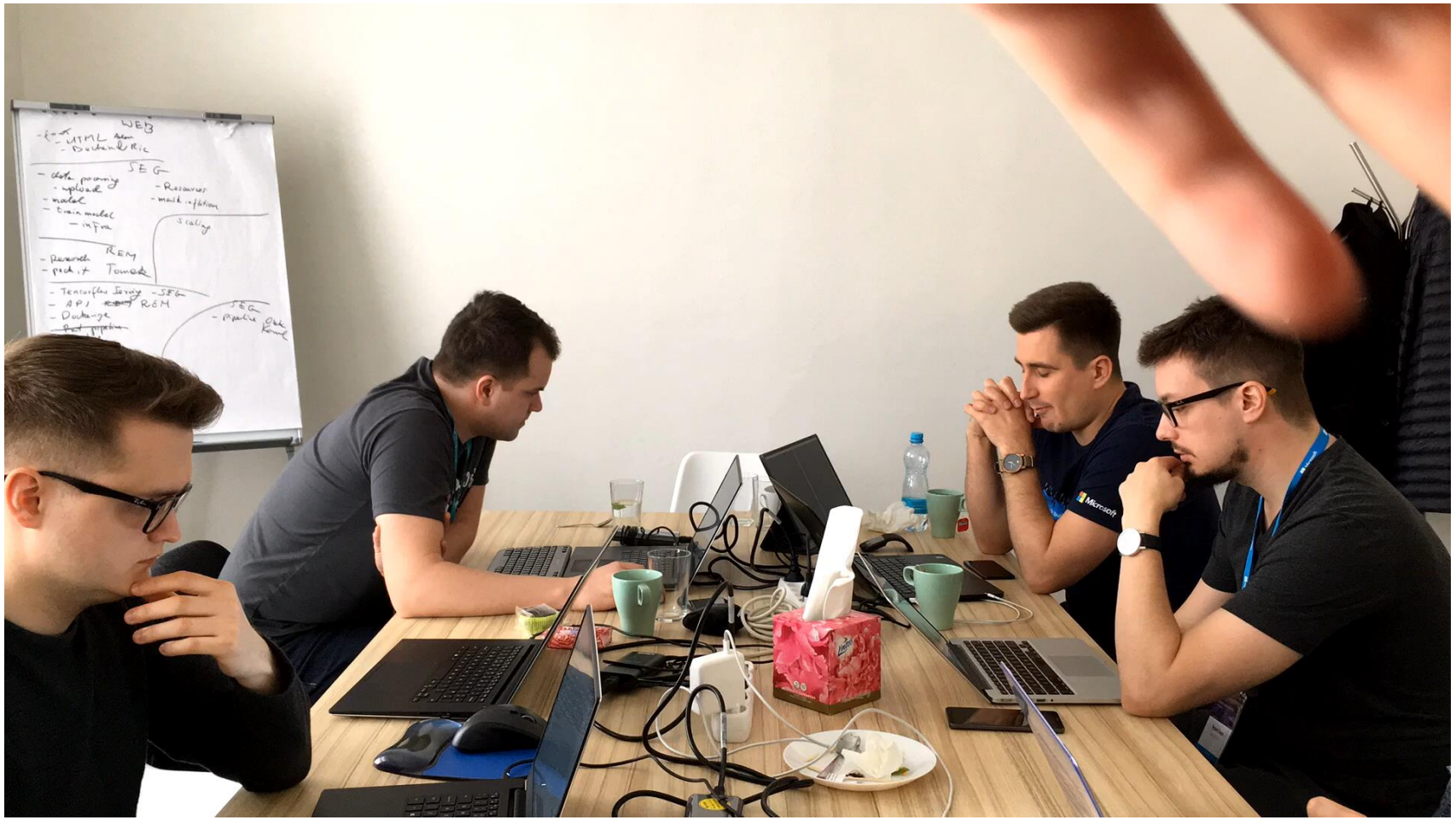
MicroscopeIT

Computer Vision

Deep Learning



Microsoft

netguru

Removing cranes with deep learning

Cranes

Cranes

Cranes

Cranes

Can we do something about it?

Manually - Photoshop

Cool. But how to automate it?

Find it

Find it

Find it

Find it

Remove it

Put something in its place

Put something in its place

Some results


BNP PARIBAS


BNP PARIBAS


CEVA


CEVA


NASA
MULTIPLEX
Up


MULTIPLEX

How we did it?

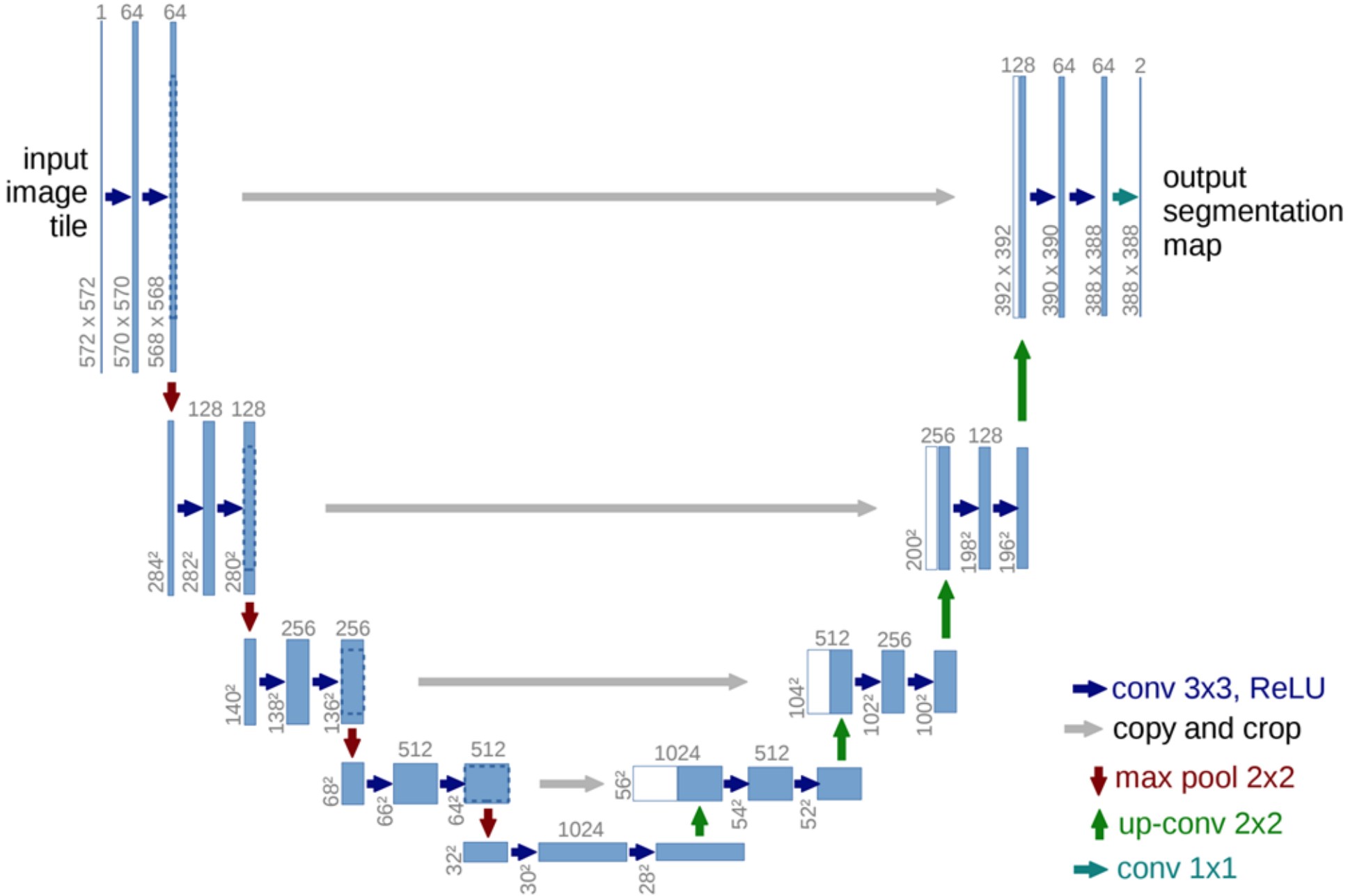
Finding the cranes

Olaf Ronneberger, Philipp Fischer, Thomas Brox

U-Net: Convolutional Networks for Biomedical Image Segmentation

2015

arXiv:1505.04597


input image tile
output segmentation map
1
64
64
572 x 572
570 x 570
568 x 568
128
128
284²
282²
280²
256
256
140²
138²
136²
512
512
68²
66²
64²
1024
32²
30²
28²
1024
512
56²
54²
52²
512
256
104²
102²
100²
256
128
200²
198²
196²
128
64
64
2
392 x 392
390 x 390
388 x 388
388 x 388
conv 3x3, ReLU
copy and crop
max pool 2x2
up-conv 2x2
conv 1x1

Vanilla U-Net

- 5 layers
- Padding in conv layers

Our best U-Net

- 6 layers
- No padding in conv layers

How did it go?

Metric: mean Intersection Over Union (IoU)

$$\text{IoU} = \frac{\text{Area of Overlap}}{\text{Area of Union}}$$

55.55%

Our best U-Net-like mean IoU

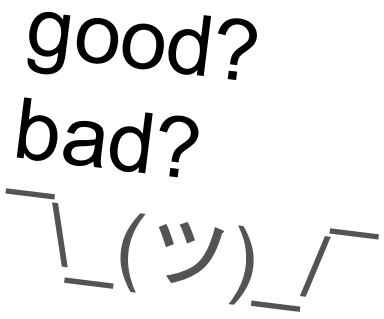
55.55%

Our best U-Net-like mean IoU

good?
bad?

55.55%

Our best U-Net-like mean IoU



55.55%

Our best U-Net-like mean IoU

+3.99% over vanilla

(51.56%)

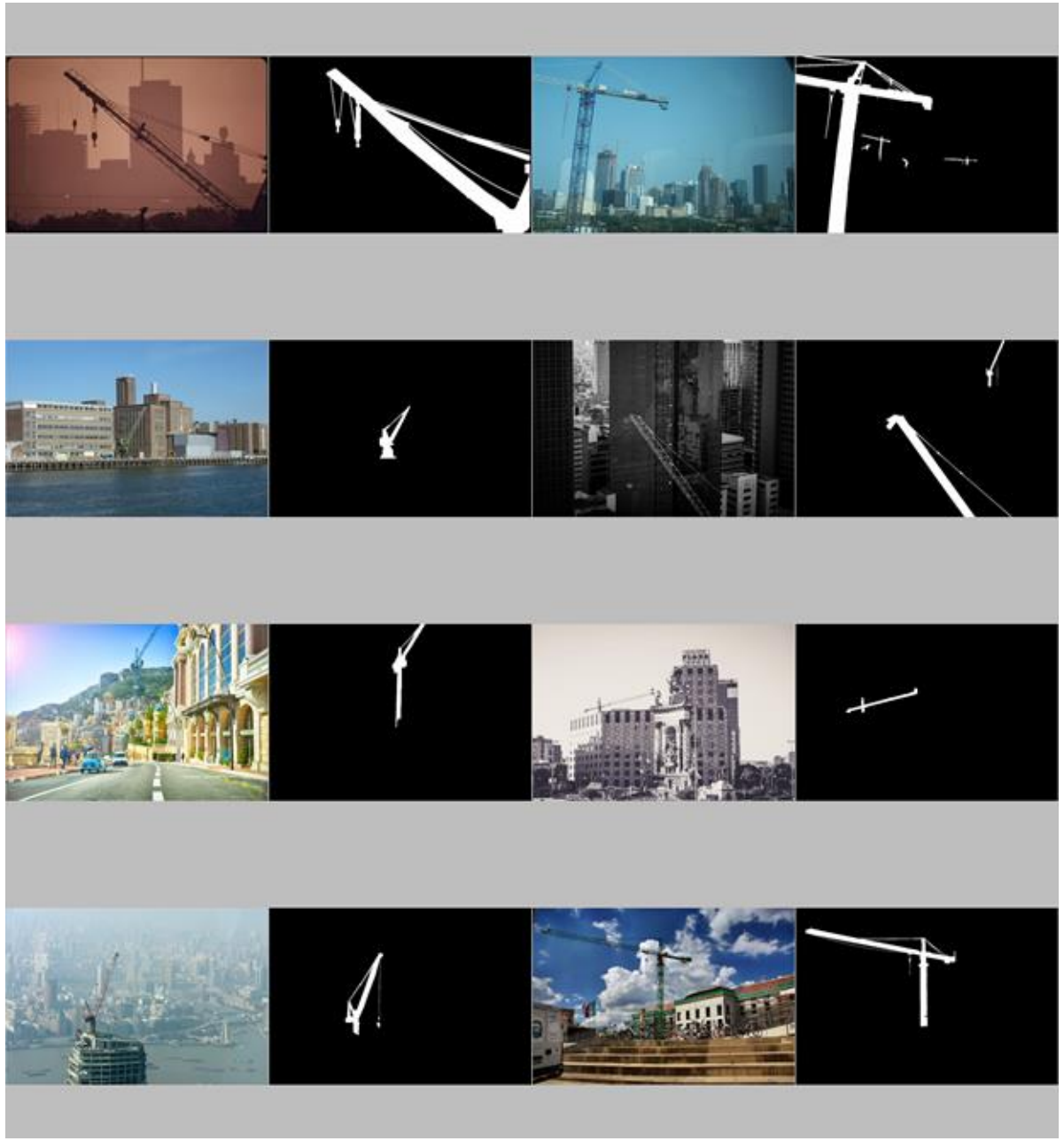
55.55%

Our best U-Net-like mean IoU

+3.99% over vanilla (51.56%)

results look good

The dataset



Dataset

917 cityscapes

(with and without cranes)

Annotated manually

2 iterrations:

v1 – large brush

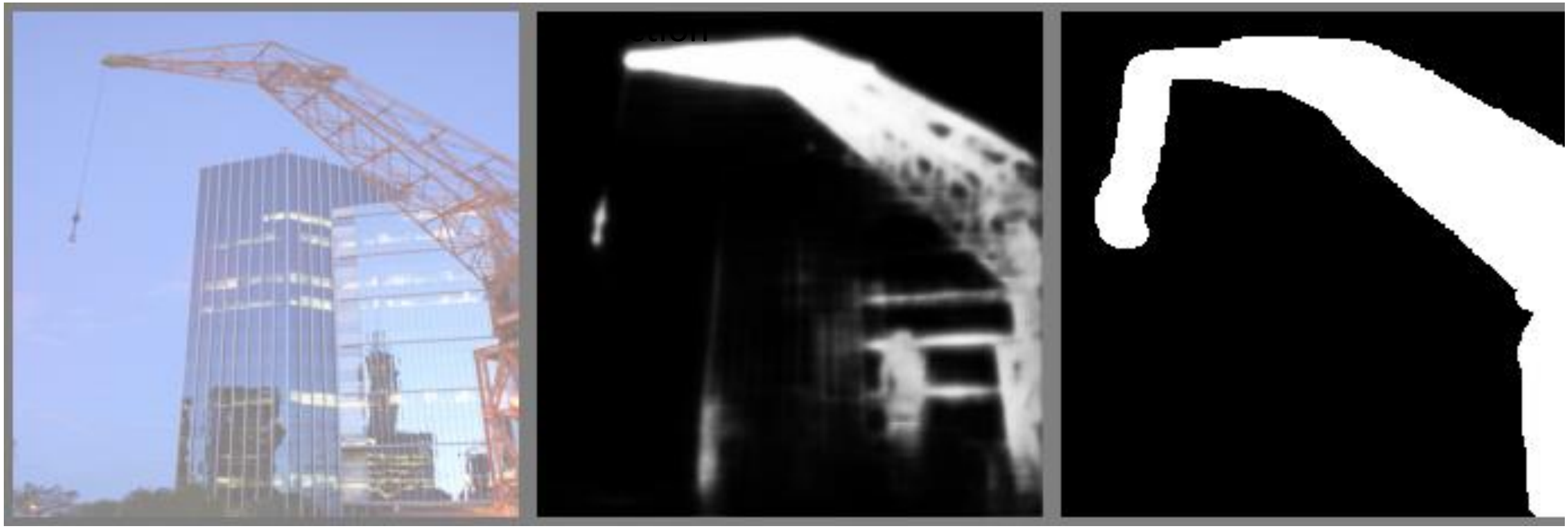
v2 – smaller brush

What's wrong in this picture?

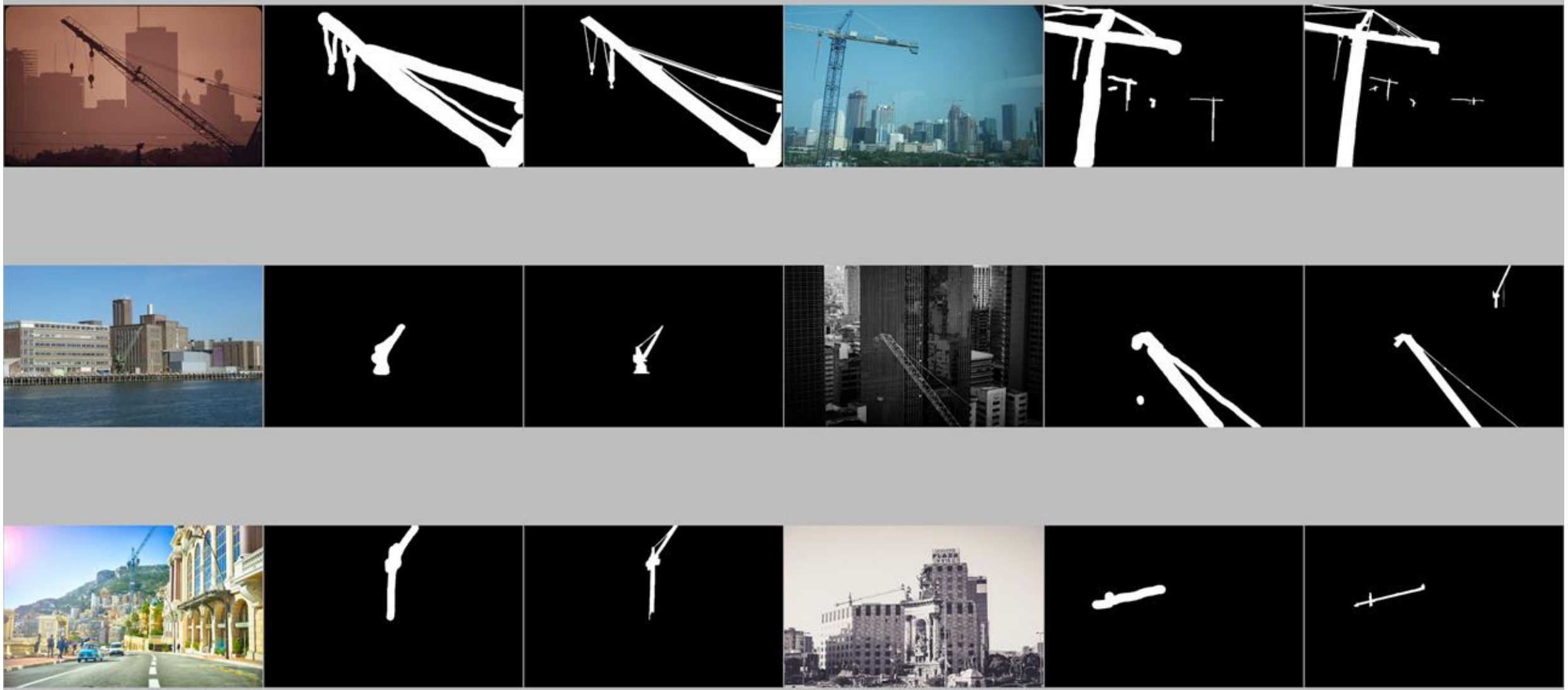
original

network's

human annotator



Redo the dataset!



+2.63%

mean IOU 48.9% → 51.5%

Vanilla U-Net

old vs new dataset

Running multiple trainings to find the best model

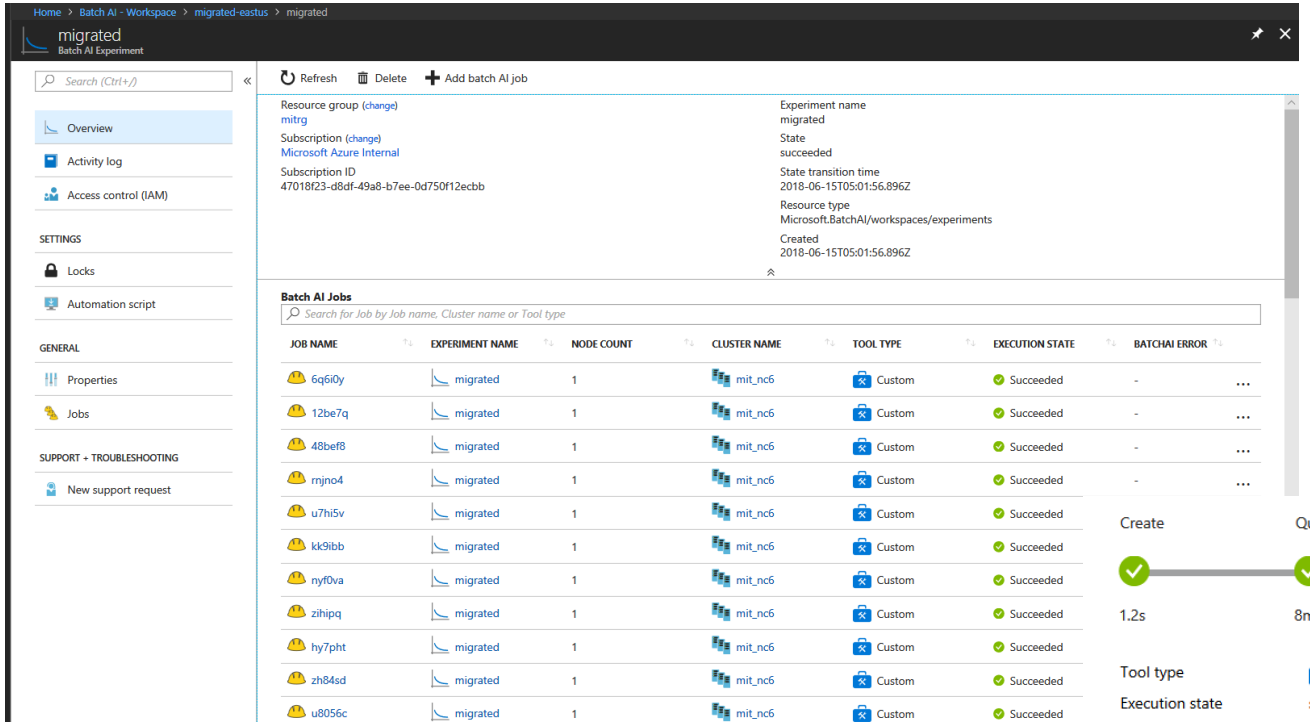
~5000 hours

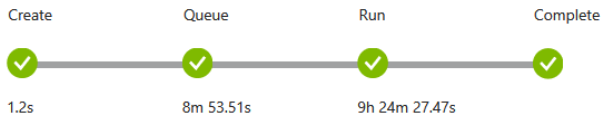
of NC6 VM instances with Tesla K-80 GPU

~700 epochs = ~1.5-2 days

for the best model to train

We used Azure Batch AI to run our training jobs





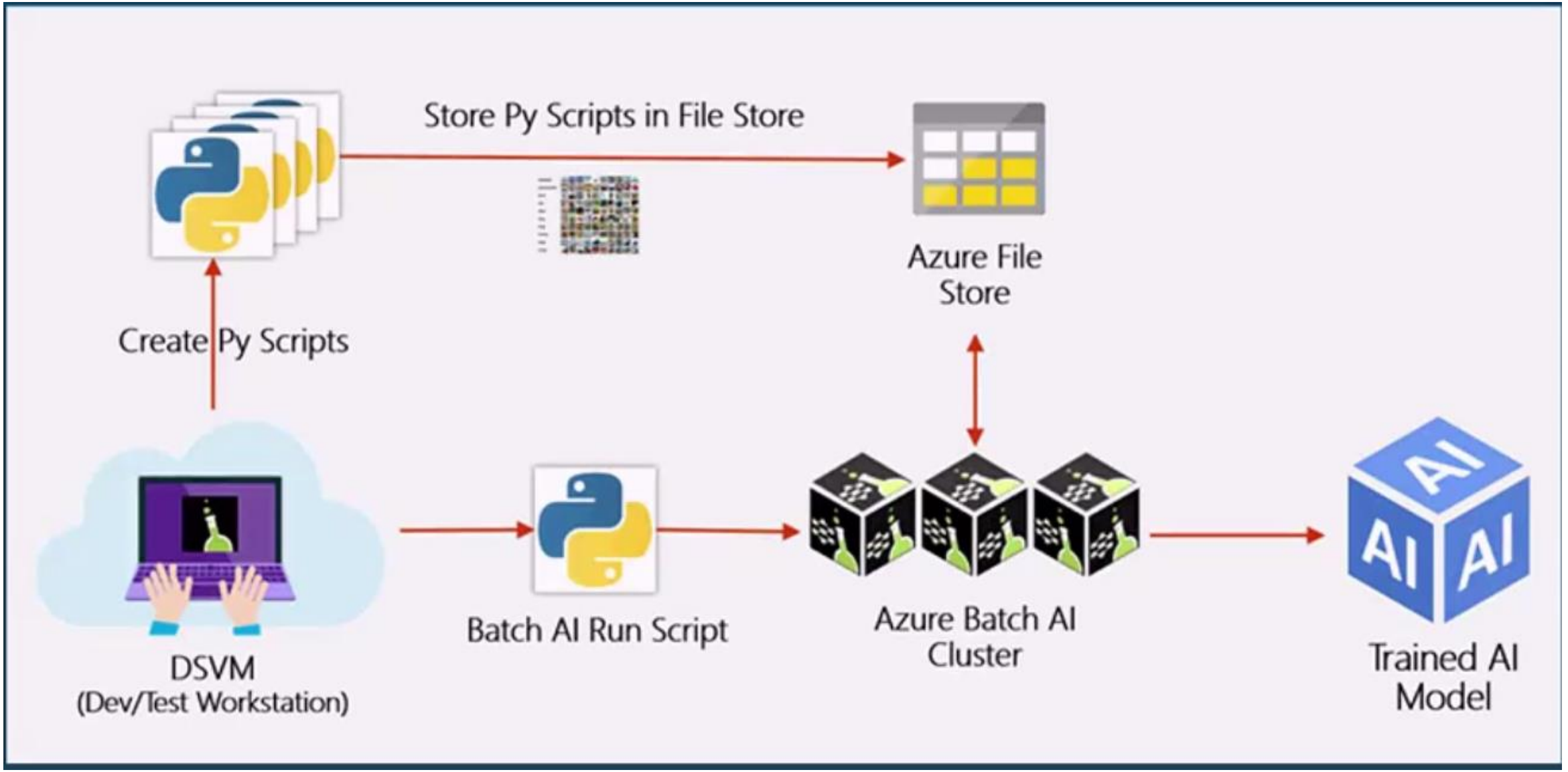
Tool type: Custom
Execution state: succeeded
Duration: 9h 33m 22.0s
Submitted: Monday, April 16, 2018 15:25:13
Cluster name: mit_nc6

Show more

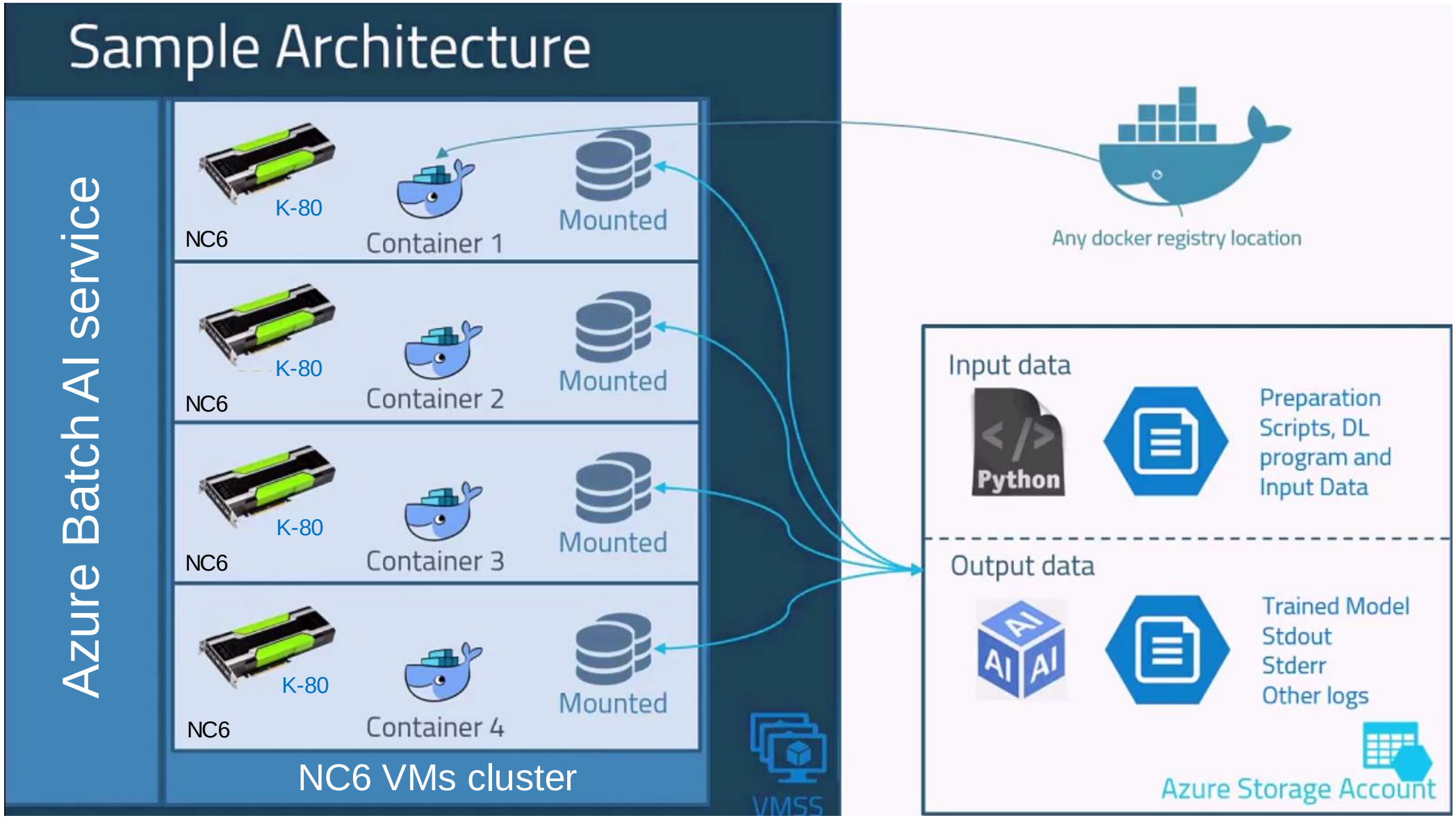
Output directory: stdouterr

FILE NAME	IS DIR...	DOWNLOAD URL	CONTENT LE...	LAST MODIFIED TIME
execution.log	No	https://mitstorageaccount.file.core.windows.net/afscraneremover/47018f23-d...	18.4 KB	Tuesday, April 17, 2018 00:58:34
stderr.txt	No	https://mitstorageaccount.file.core.windows.net/afscraneremover/47018f23-d...	1.2 KB	Monday, April 16, 2018 15:36:10
stdout.txt	No	https://mitstorageaccount.file.core.windows.net/afscraneremover/47018f23-d...	26.6 KB	Tuesday, April 17, 2018 00:58:12

Azure Batch AI



Azure Batch AI



Replace cranes with something valid

Satoshi Iizuka, Edgar Simo-Serra, and Hiroshi Ishikawa

Globally and Locally Consistent Image Completion

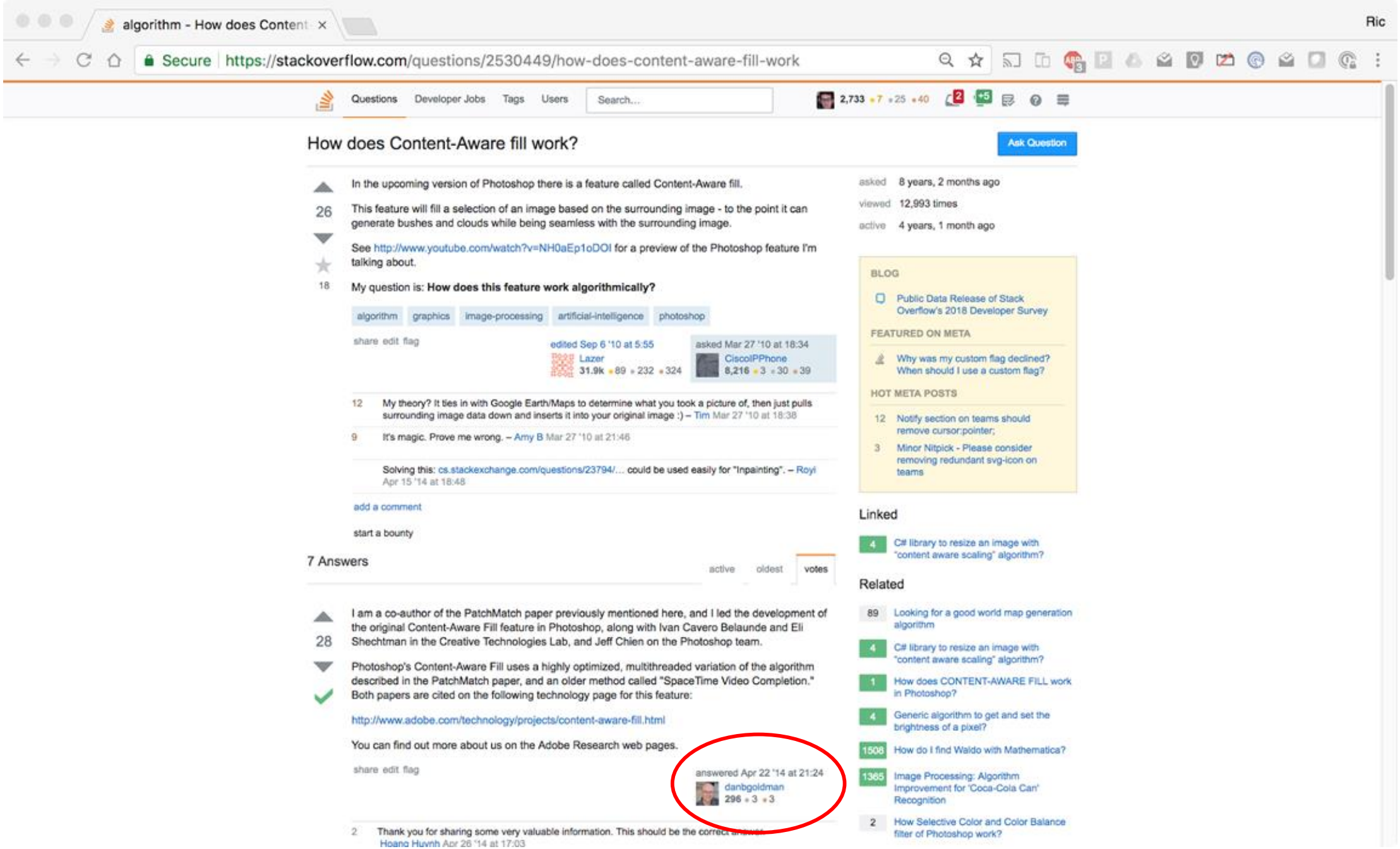
2017

ACM Transaction on Graphics (Proc. of SIGGRAPH 2017)

Promising

Ooops...

What does Photoshop do?


algorithm - How does Content
Secure https://stackoverflow.com/questions/2530449/how-does-content-aware-fill-work
Questions Developer Jobs Tags Users Search...
How does Content-Aware fill work?
Ask Question
In the upcoming version of Photoshop there is a feature called Content-Aware fill.
This feature will fill a selection of an image based on the surrounding image - to the point it can generate bushes and clouds while being seamless with the surrounding image.
See http://www.youtube.com/watch?v=NH0aEp1oDOI for a preview of the Photoshop feature I'm talking about.
My question is: How does this feature work algorithmically?
algorithm graphics image-processing artificial-intelligence photoshop
share edit flag
edited Sep 6 '10 at 5:55 Lazer
asked Mar 27 '10 at 18:34 CiscoIPPhone
My theory? It ties in with Google Earth/Maps to determine what you took a picture of, then just pulls surrounding image data down and inserts it into your original image :) – Tim Mar 27 '10 at 18:38
It's magic. Prove me wrong. – Amy B Mar 27 '10 at 21:46
Solving this: cs.stackexchange.com/questions/23794/... could be used easily for "Inpainting". – Royi Apr 15 '14 at 18:48
add a comment
start a bounty
7 Answers
active oldest votes
I am a co-author of the PatchMatch paper previously mentioned here, and I led the development of the original Content-Aware Fill feature in Photoshop, along with Ivan Cavero Belaunde and Eli Shechtman in the Creative Technologies Lab, and Jeff Chien on the Photoshop team.
Photoshop's Content-Aware Fill uses a highly optimized, multithreaded variation of the algorithm described in the PatchMatch paper, and an older method called "SpaceTime Video Completion." Both papers are cited on the following technology page for this feature:
http://www.adobe.com/technology/projects/content-aware-fill.html
You can find out more about us on the Adobe Research web pages.
share edit flag
answered Apr 22 '14 at 21:24 danbgoldman
Thank you for sharing some very valuable information. This should be the correct answer.
Hoang Huynh Apr 26 '14 at 17:03
asked 8 years, 2 months ago
viewed 12,993 times
active 4 years, 1 month ago
BLOG
Public Data Release of Stack Overflow's 2018 Developer Survey
FEATURED ON META
Why was my custom flag declined? When should I use a custom flag?
HOT META POSTS
12 Notify section on teams should remove cursor:pointer;
3 Minor Nitpick - Please consider removing redundant svg-icon on teams
Linked
4 C# library to resize an image with "content aware scaling" algorithm?
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4 C# library to resize an image with "content aware scaling" algorithm?
1 How does CONTENT-AWARE FILL work in Photoshop?
4 Generic algorithm to get and set the brightness of a pixel?
1508 How do I find Waldo with Mathematica?
1365 Image Processing: Algorithm Improvement for 'Coca-Cola Can' Recognition
2 How Selective Color and Color Balance filter of Photoshop work?

Barnes, C., Shechtman, E., Finkelstein, A., Goldman, D.

PatchMatch: A randomized correspondence algorithm for structural image editing

2009

ACM Transactions on Graphics (Proc. SIGGRAPH), 28(3), 2009.

G’MIC

https://gmic.eu/

Open Source

Used by GIMP for Content-Aware Fill

Good results!

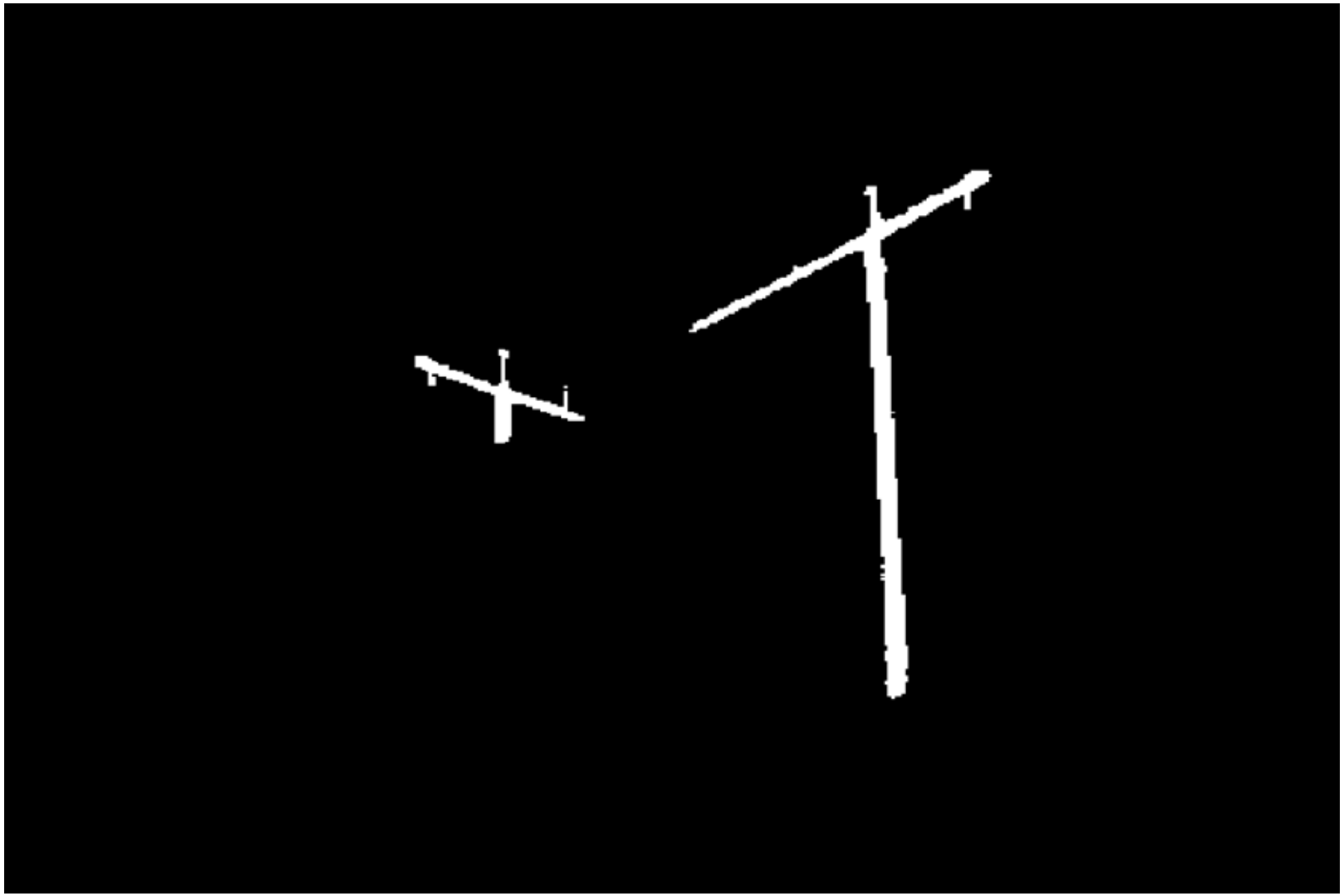
Mostly...


YOU ARE TECHNICALLY CORRECT
THE BEST KIND OF CORRECT.

Postprocessing tricks

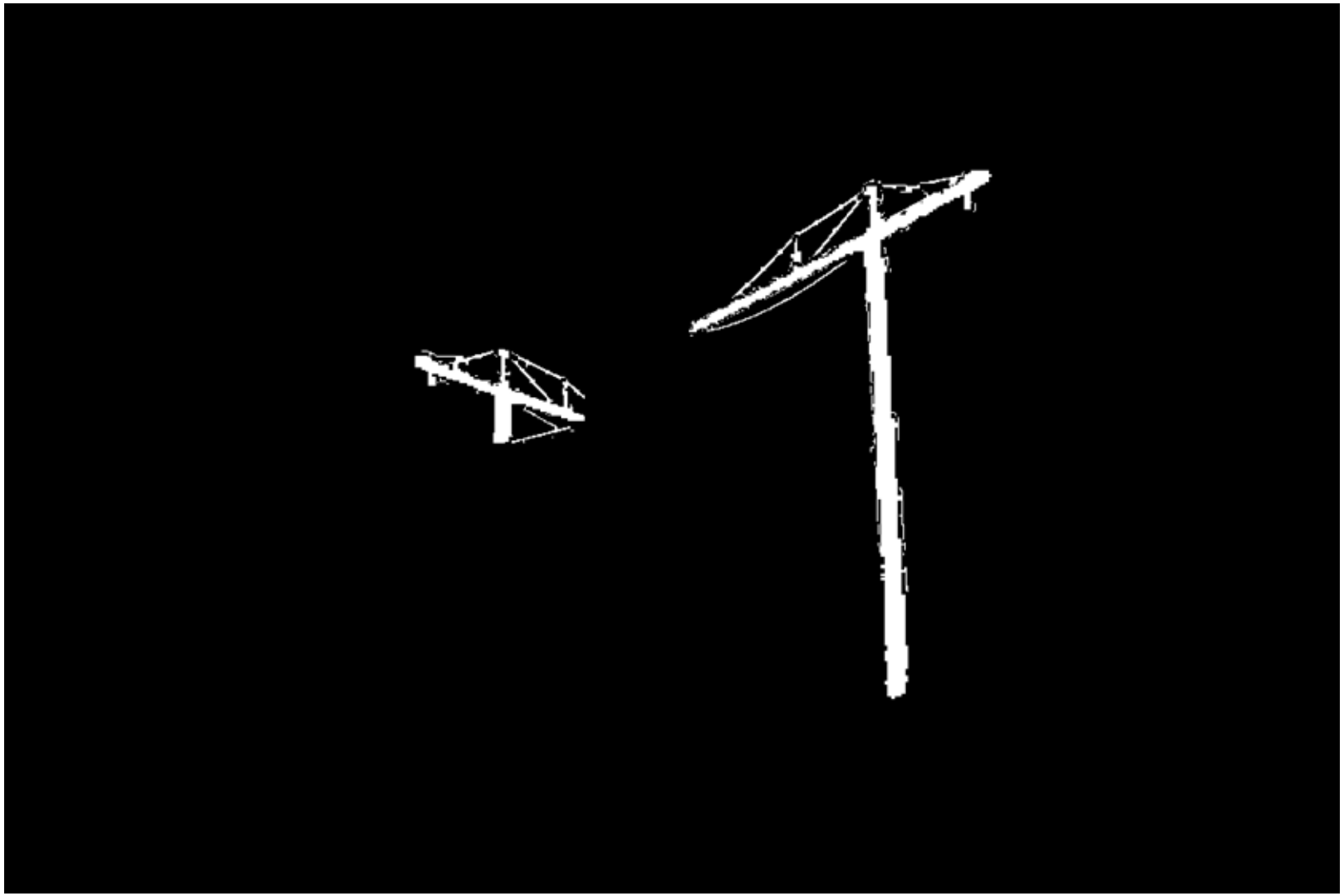
Cables were hard – original picture

Cables were hard – mask without postprocessing



Cables were hard – results from GMIC v1

Cables were hard – mask with postprocessing



Cables were hard – results from GMIC v2

Cables were hard – original picture

alterpast-hackathon-prague

prettycity.io/#/

Step 1
Upload your picture

Step 2
Our magic happens

Step 3
Enjoy the results

Reversing the screws alignment

We're doing some real magic here, it should not take longer than 7 seconds.

...Well, 15 is still okay for that complex tasks!

alterpast-hackathon-prague

prettycity.io/#/

Step 1
Upload your picture

Step 2
Our magic happens

Step 3
Enjoy the results

http://prettycity.io

Reversing the screws alignment

We're doing some real magic here, it should not take longer than 7 seconds.

...Well, 15 is still okay for that complex tasks!

Key takeaways

1. Don’t trust papers

2. Data is key

3. Classic methods still have their place

Questions?

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Thank you!