Understanding Text on Images with AI at Scale

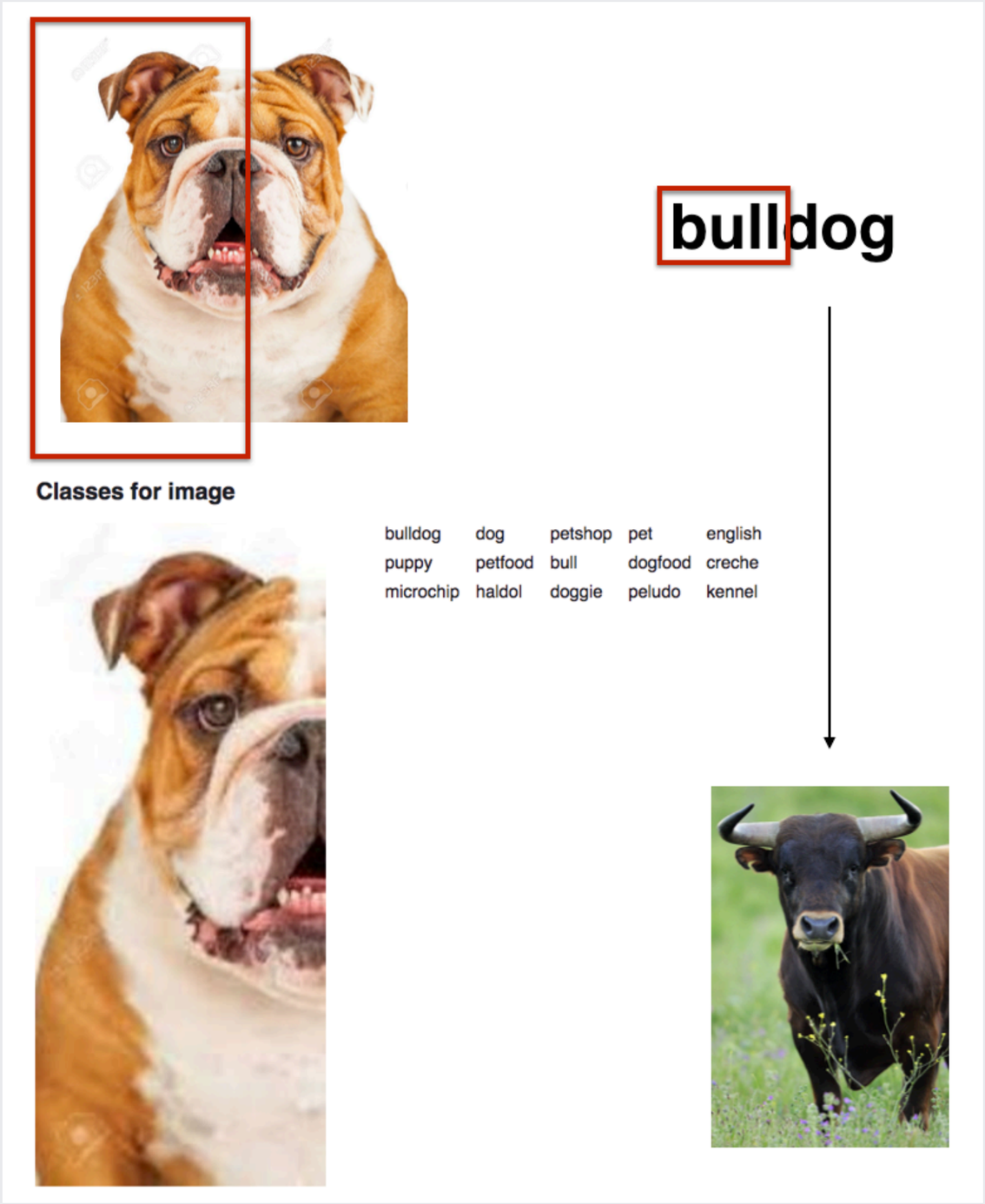
Viswanath Sivakumar

Facebook AI Research (FAIR)

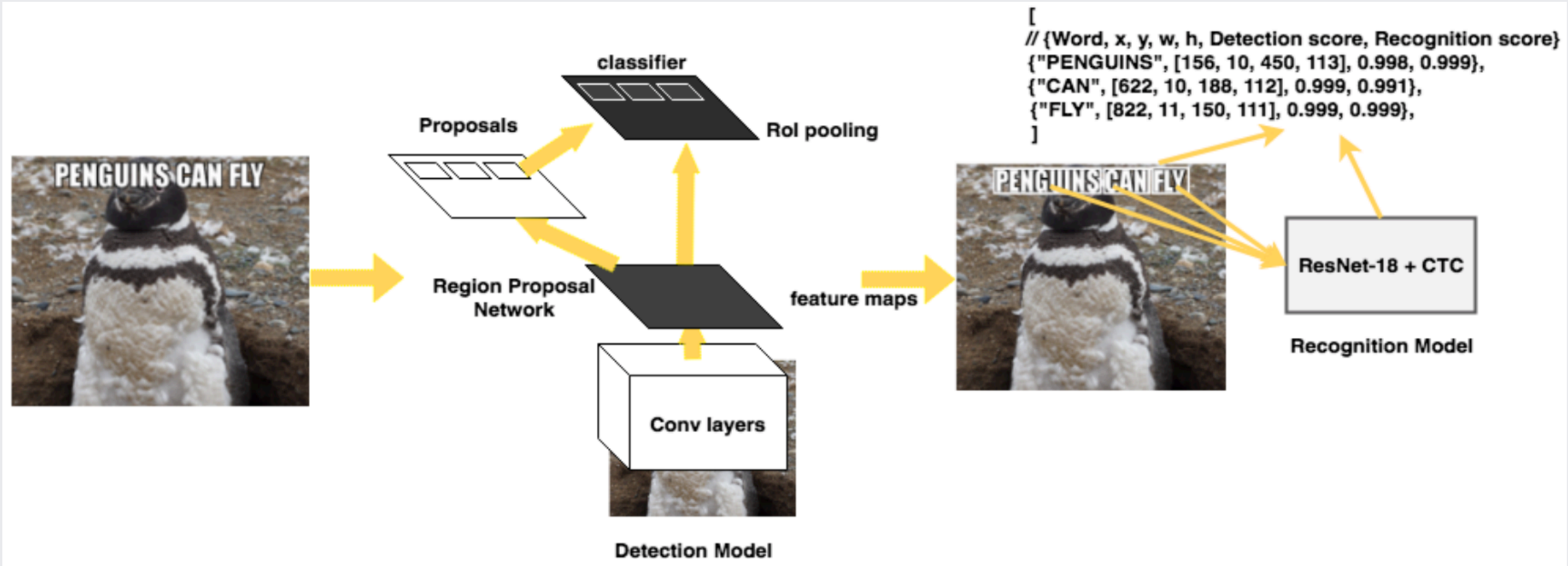

PINGUINO FELIZ TE ESPERA
PINGUINO FELIZ TE ESPERA
EN MAGDALENA EN 2018
EN MAGDALENA EN 2018
VIENES?
VIENES?

Challenges

- Sizes, fonts, orientations
- Languages
- Scale
- Efficiency

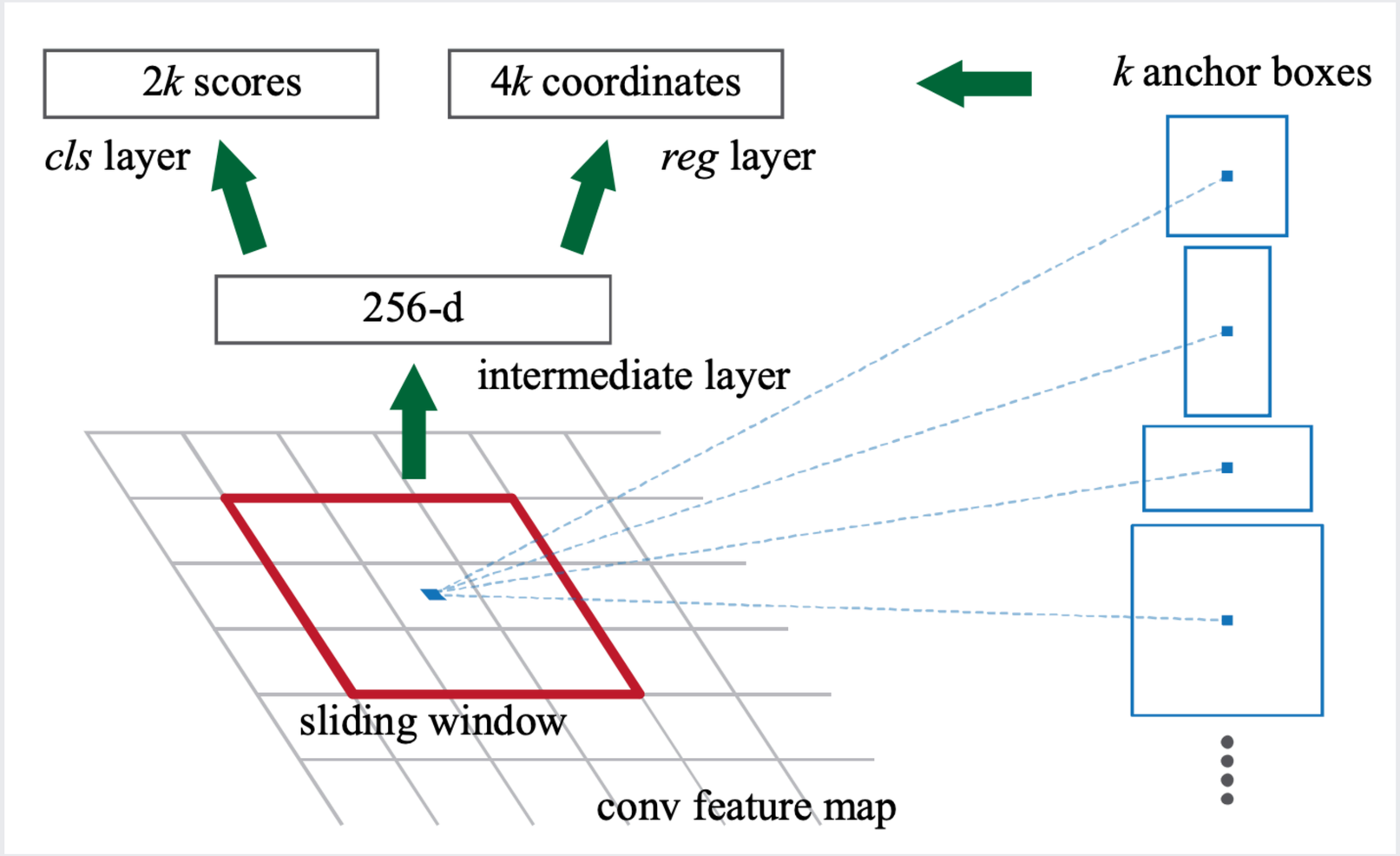


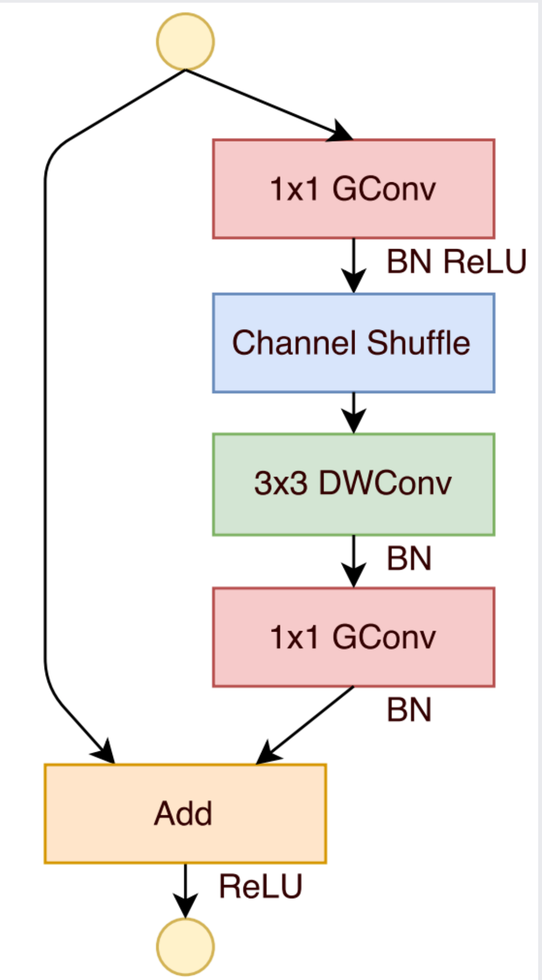
Architecture



Large scale system for text detection and recognition in images, KDD 2018, Viswanath Sivakumar, Albert Gordo, Fedor Borisyuk

Text Detection

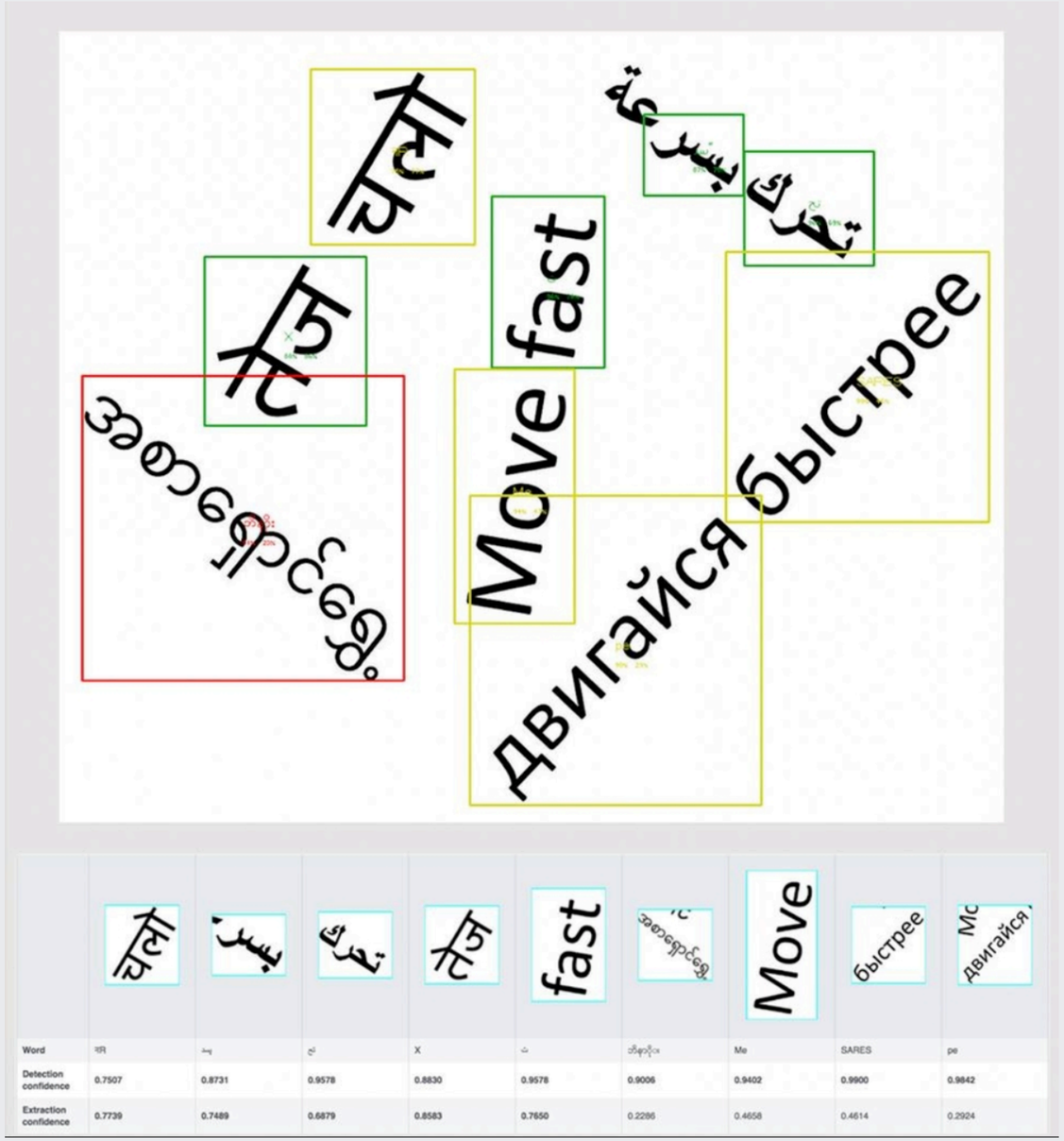




Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Networks, Ren et al.

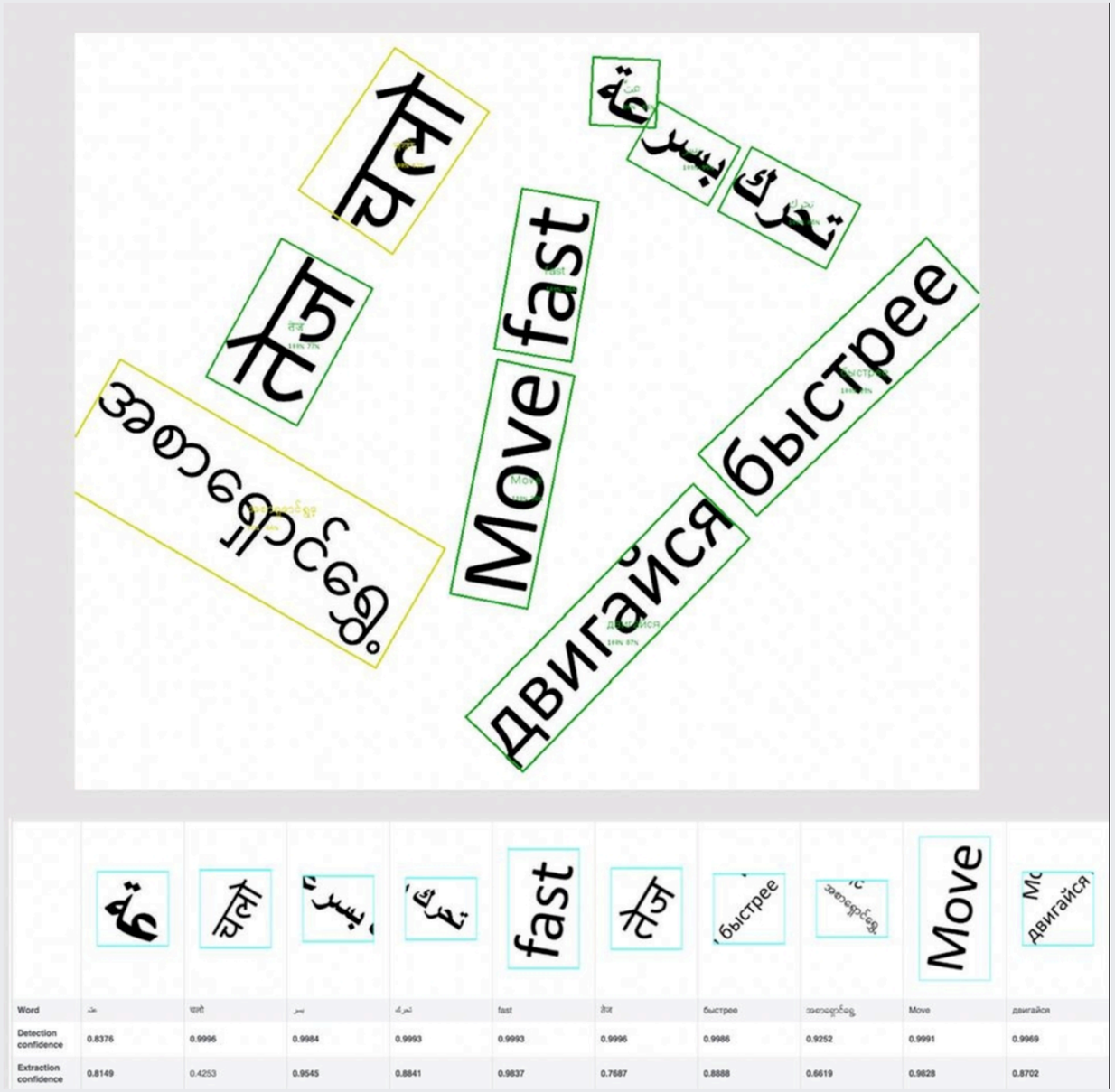
ShuffleNet: An Extremely Efficient Convolutional Neural Network for Mobile Devices, Zhang et al.

Orientations



Word	चलो	بسرعة	تحرك	तेज	fast	ဘေးရောင်းရွှေ့	Move	быстрее	двигайся
Detection confidence	0.7507	0.8731	0.9578	0.8830	0.9578	0.9006	0.9402	0.9900	0.9842
Extraction confidence	0.7739	0.7489	0.6879	0.8583	0.7650	0.2286	0.4658	0.4614	0.2924

Orientations



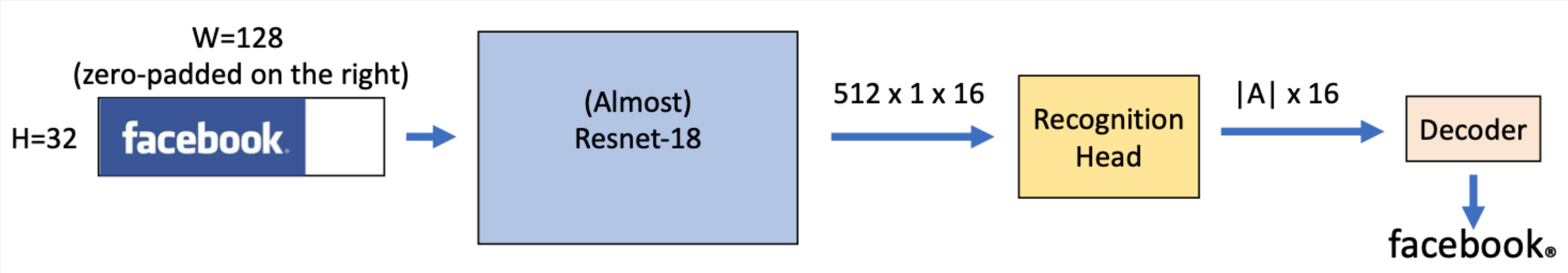
Word	عة	चला	بسر	تحرك	fast	तेज़	быстрее	အမြန်ရွှေ့	Move	двигайся
Detection confidence	0.8376	0.9996	0.9984	0.9993	0.9993	0.9996	0.9986	0.9252	0.9991	0.9969
Extraction confidence	0.8149	0.4253	0.9545	0.8841	0.9837	0.7687	0.8888	0.6619	0.9828	0.8702

Improving Rotated Text Detection with Rotation Region Proposal Networks, Huang et al.

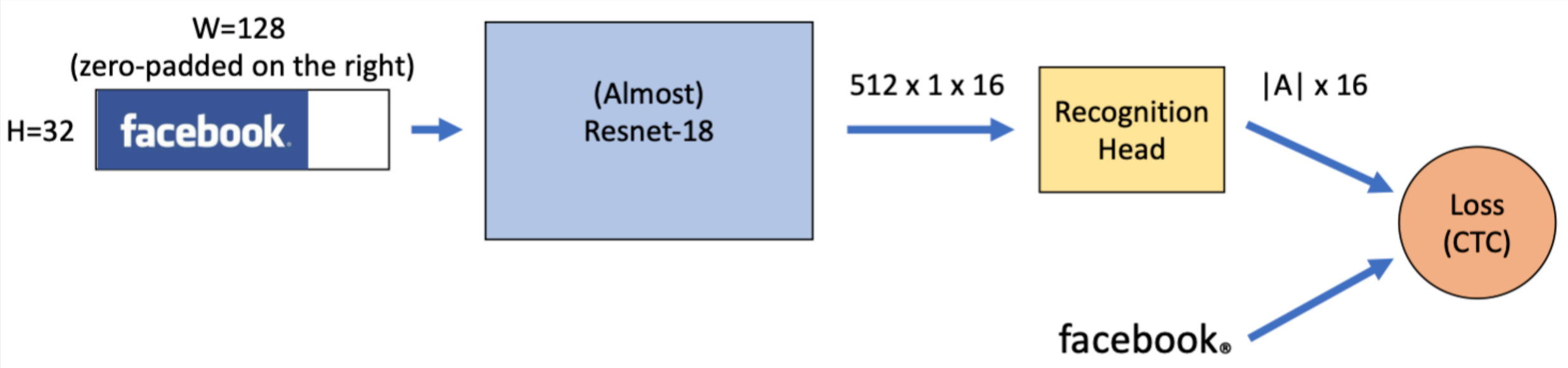
Text Recognition

Text Recognition

Text Recognition

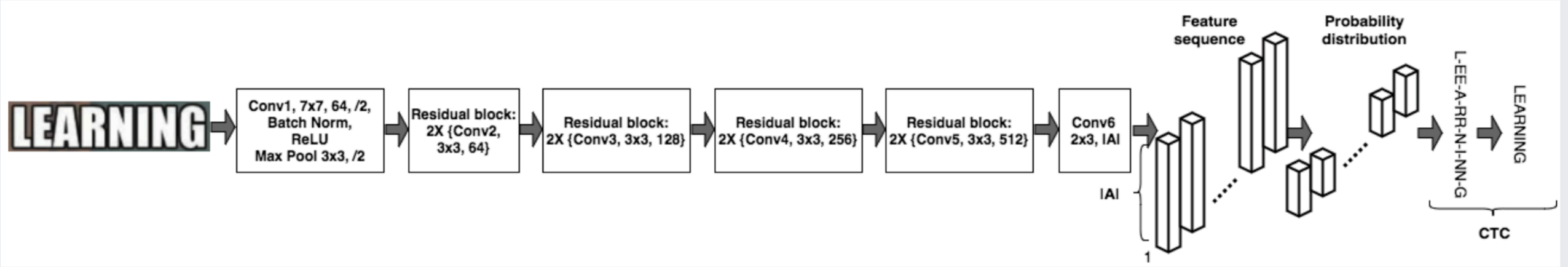


Text Recognition

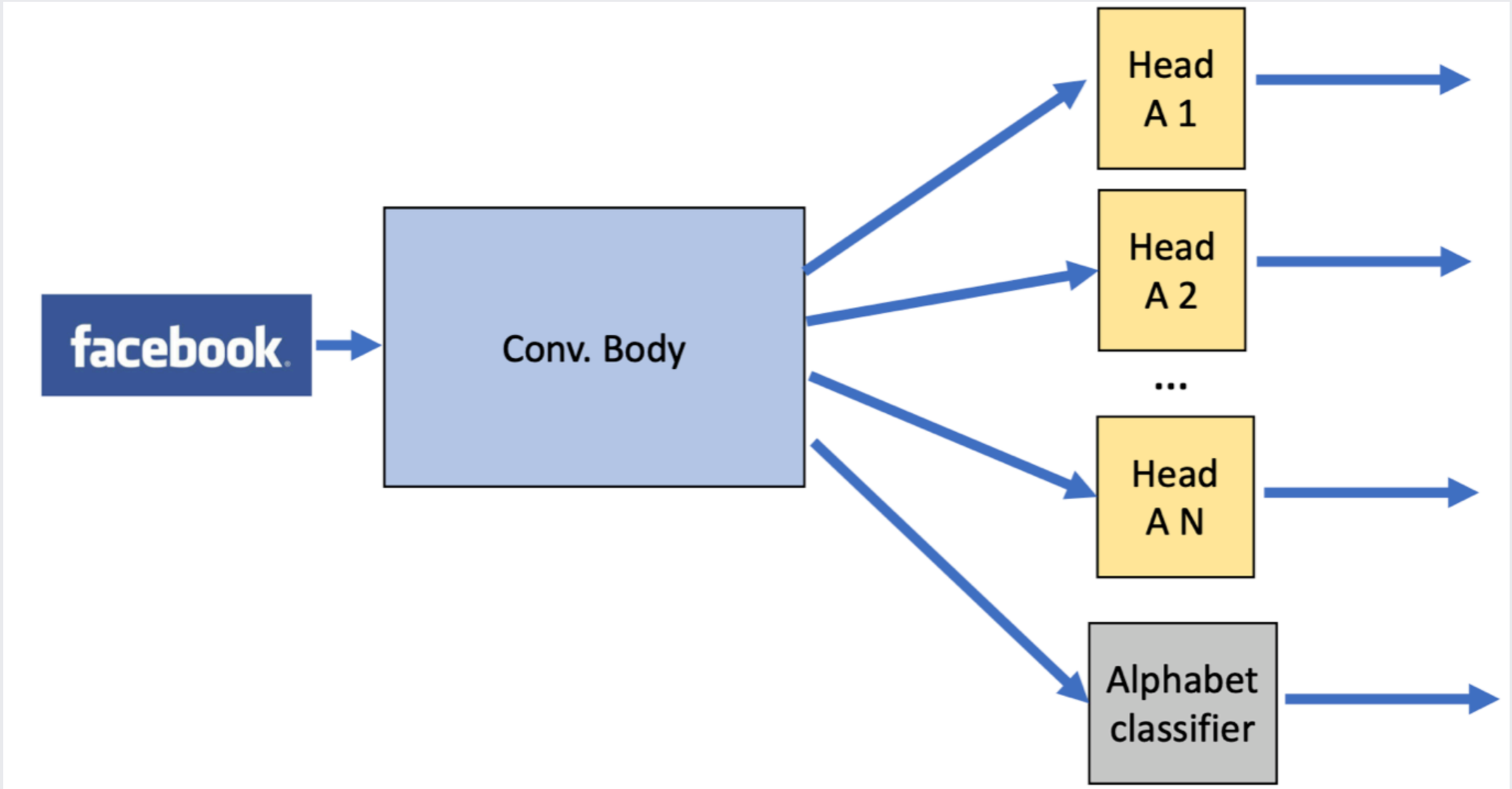


Connectionist temporal classification: Labelling unsegmented sequence data with recurrent neural networks, Graves et al.

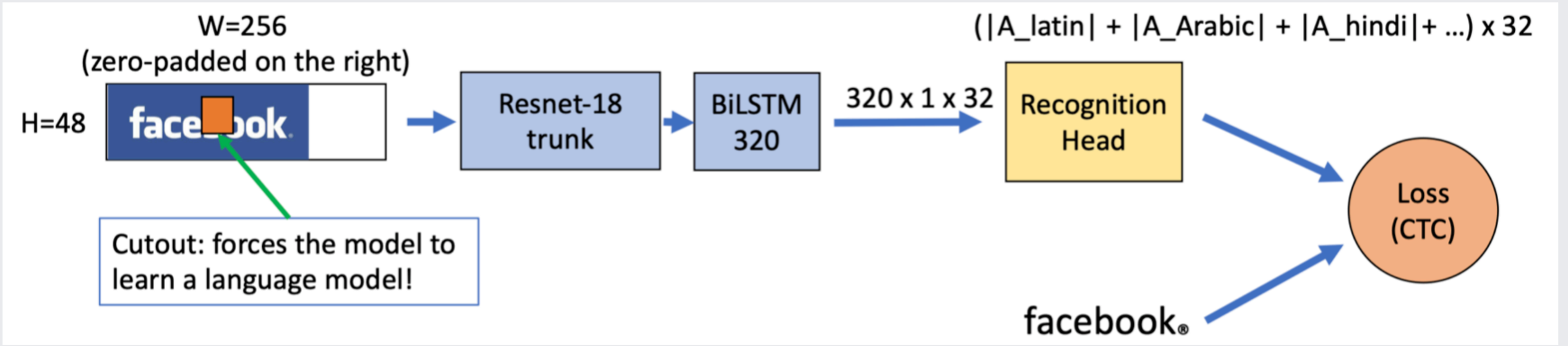
Text Recognition



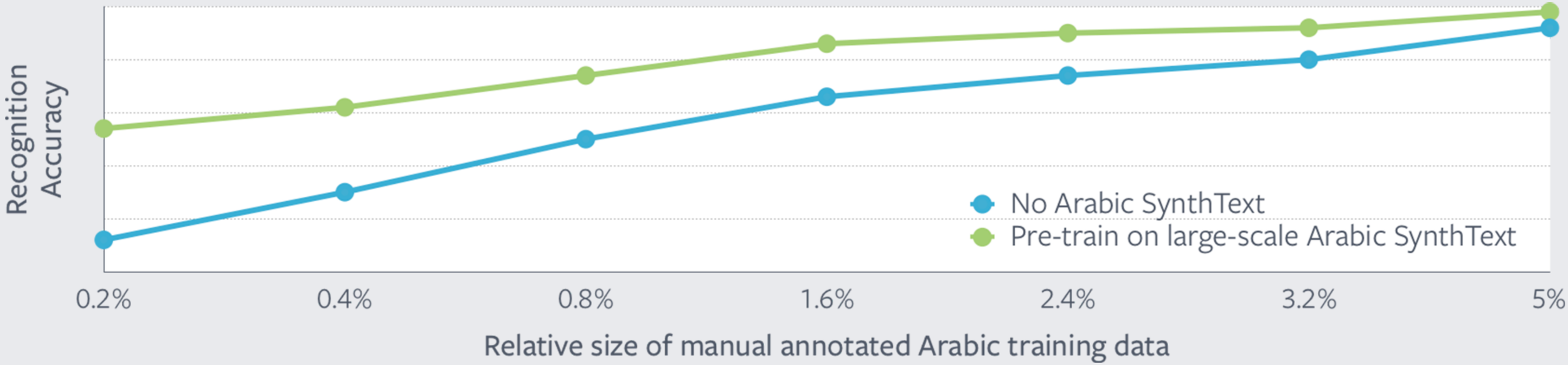
Multilingual



Multilingual



Synthetic Data



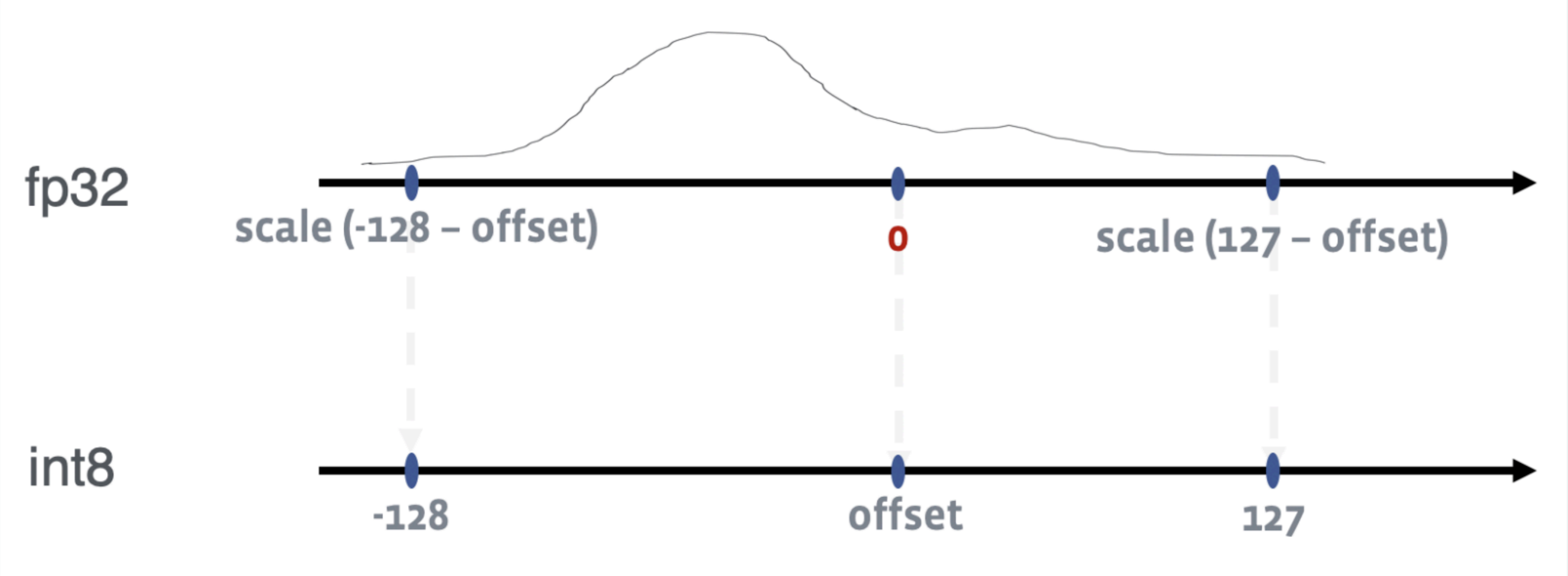
Inference

1B images/day x 5 sec/image = Lots of servers!

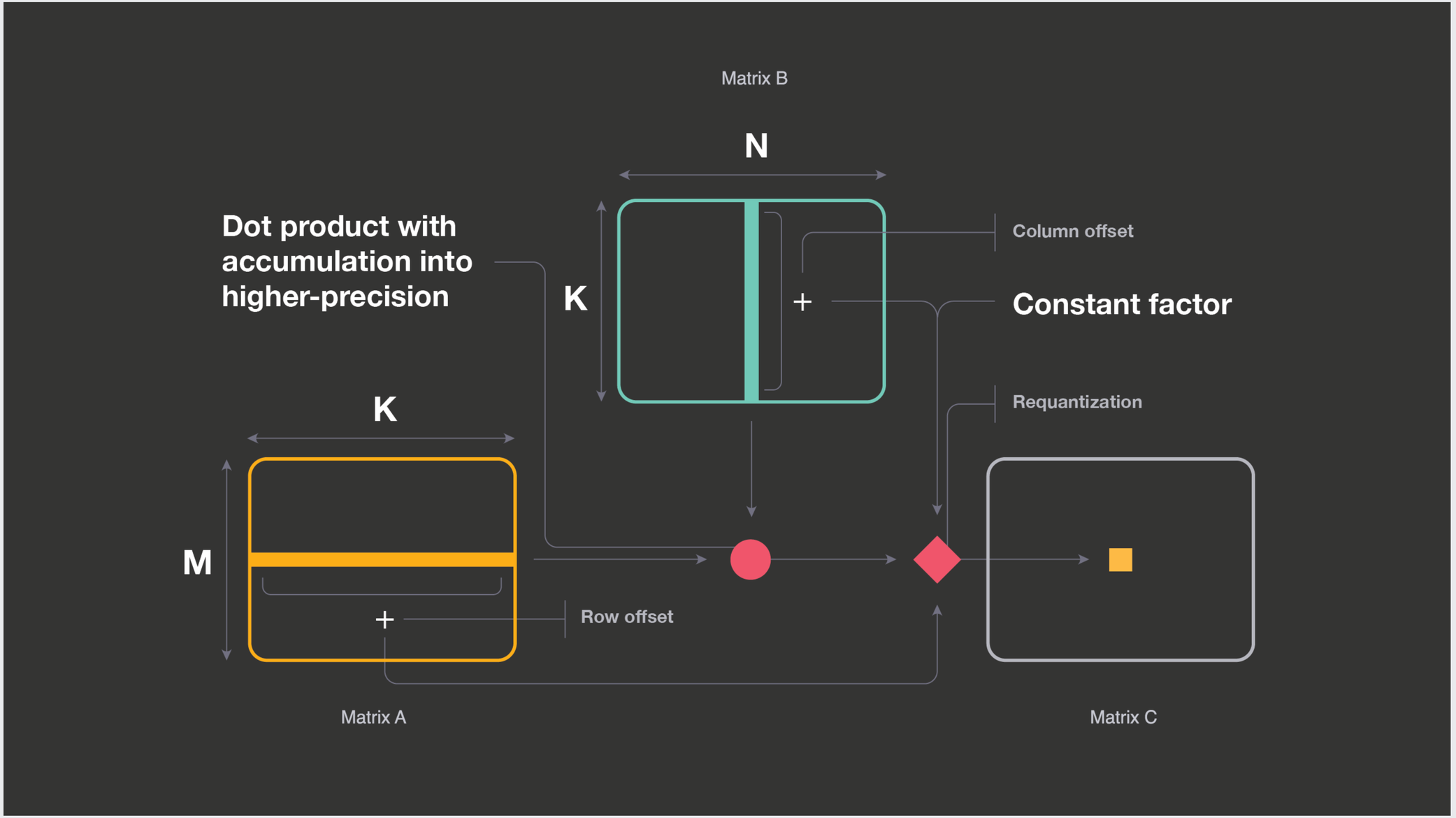
Int8 Quantization

Quantization: $x_q = clip(round(x/scale) + offset, -128,127)$

De-quantization: $x = scale \times (x_q - offset)$



Int8 Quantization



But what about accuracy?

- No quantization error for 0
- Fuse Convolution and ReLU
- L2 Error Minimization vs Min-Max
- Don't quantize the first layer

Initial accuracy gap: 5%

After: 0.2%

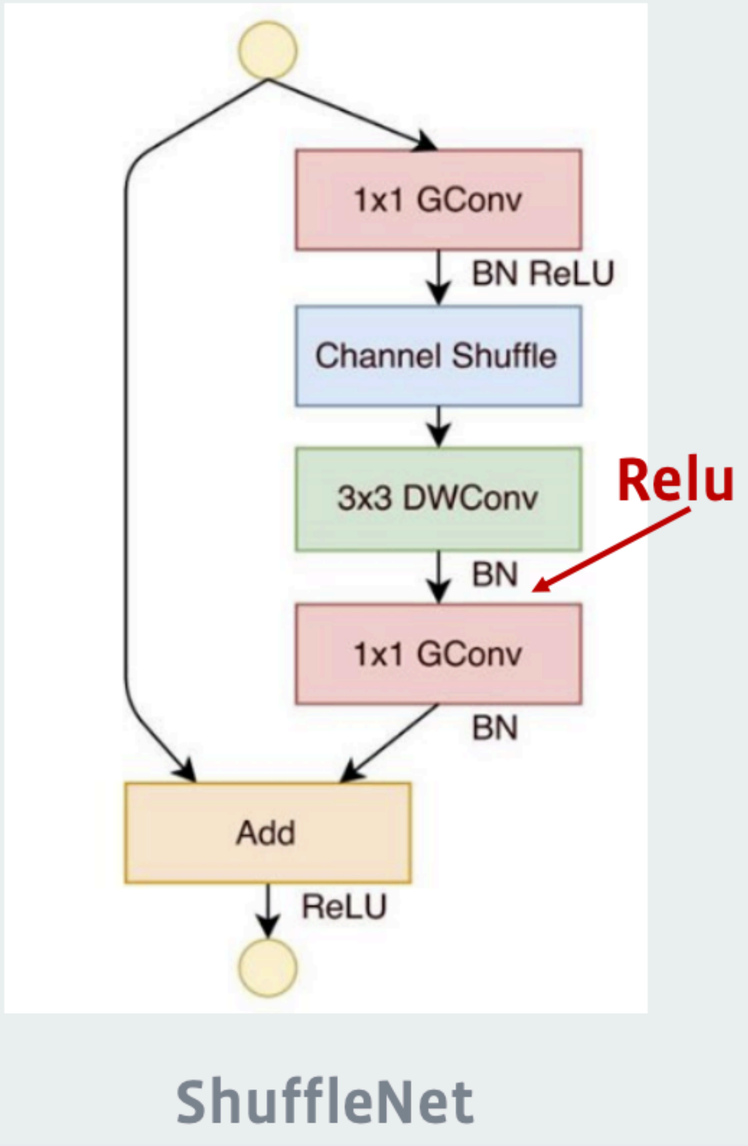
Deep Learning Inference in Facebook Data Centers: Characterization, Performance Optimizations and Hardware Implications, Park et al.

Model Co-Design

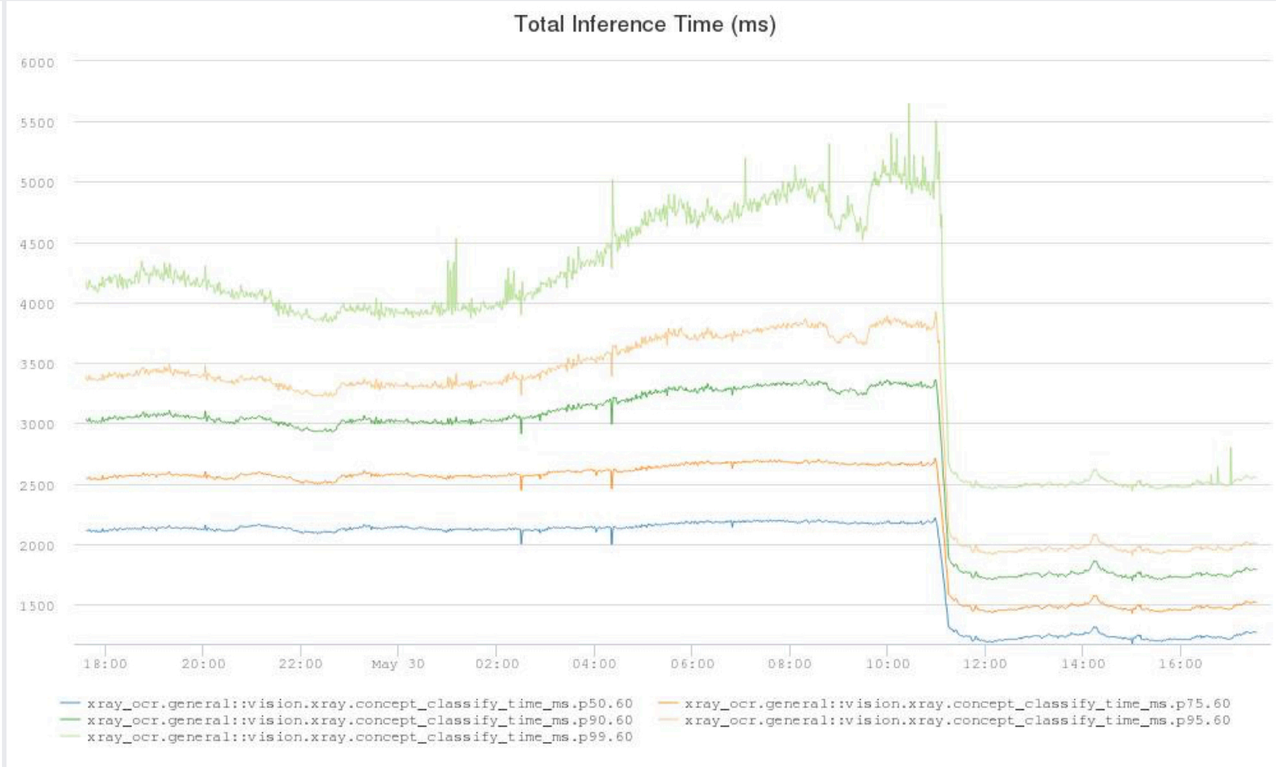
Outlier-aware quantization

- Int8 Quantization with 16-bit accumulation
- Further CPU speedup

Co-design your model and efficiency optimizations together!



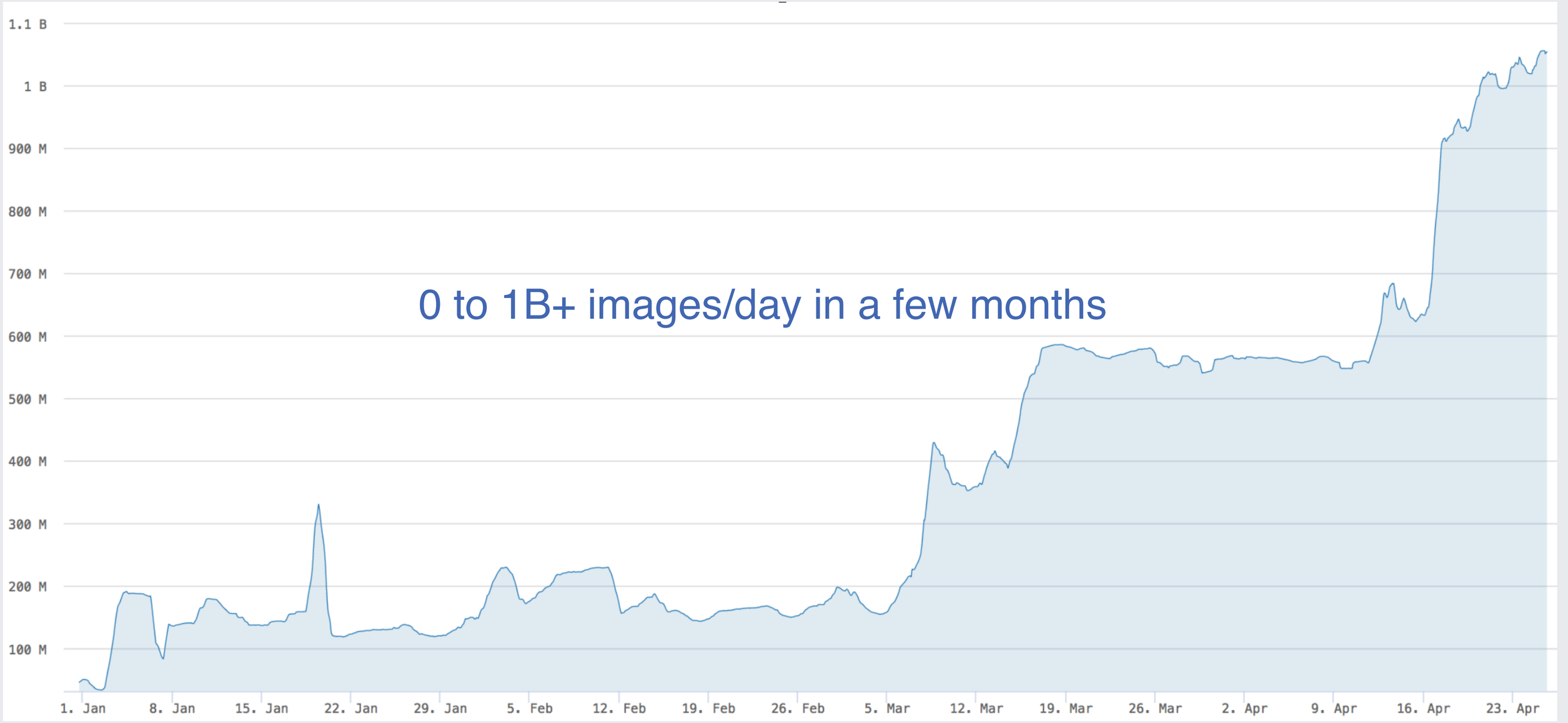
Int8 Quantization



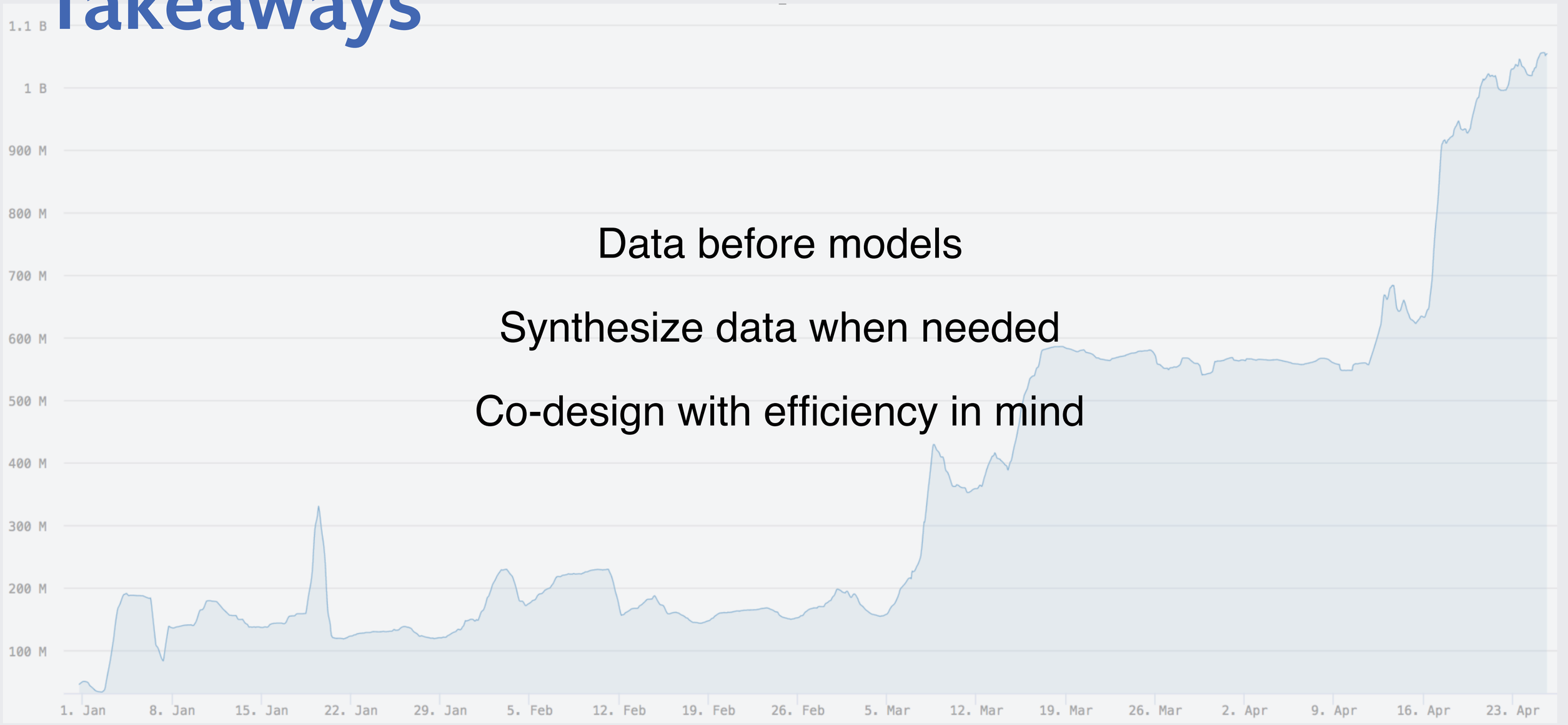
2.4x images/server

2x faster

github.com/pytorch/FBGEMM


1.1 B
1 B
900 M
800 M
700 M
600 M
500 M
400 M
300 M
200 M
100 M
0 to 1B+ images/day in a few months
1. Jan
8. Jan
15. Jan
22. Jan
29. Jan
5. Feb
12. Feb
19. Feb
26. Feb
5. Mar
12. Mar
19. Mar
26. Mar
2. Apr
9. Apr
16. Apr
23. Apr

Takeaways

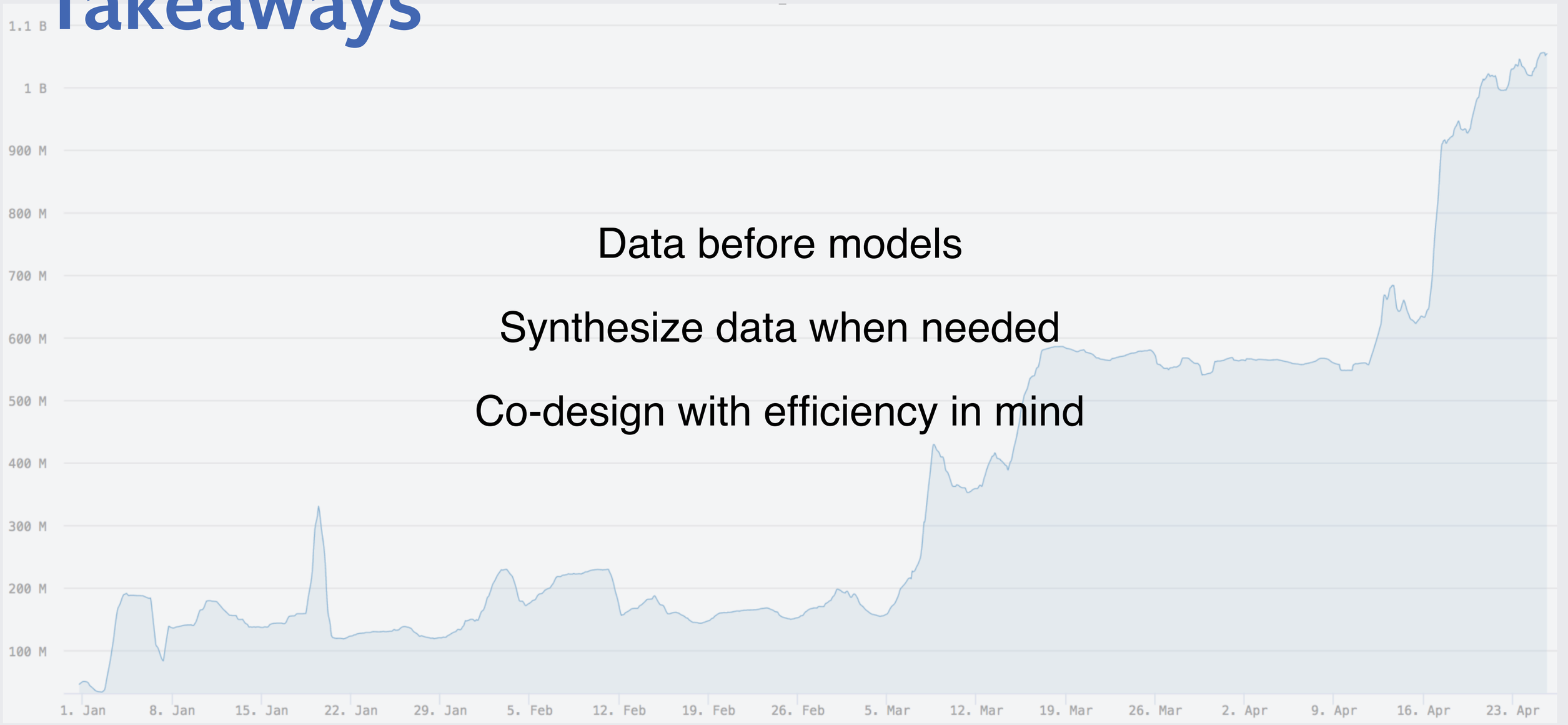


Data before models

Synthesize data when needed

Co-design with efficiency in mind

Takeaways



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Co-design with efficiency in mind

Thank You!