

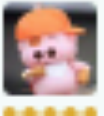

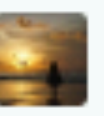










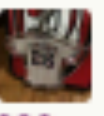

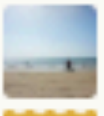







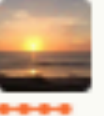
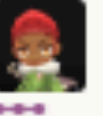

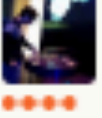

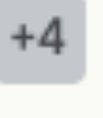

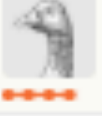

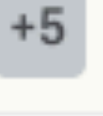
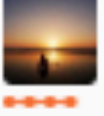
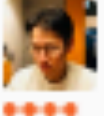






Quick, Draw! Doodle Recognition Challenge

Team

- Yauhen Babakhin
- Ivan Sosin
- Roman Solovyev
- Alex Parinov
- Roman Vlasov

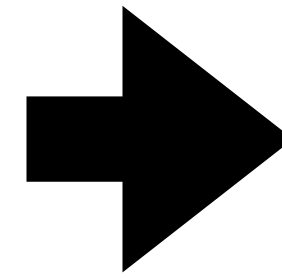
<div> <div>In the money</div> <div>Gold</div> <div>Silver</div> <div>Bronze</div> </div>									
#	△pub	Team Name	Kernel	Team Members	Score [?]	Entries	Last		
1	—	[ods.ai] Pablos		 	0.95480	79	2mo		
2	▲2	Guanshuo Xu			0.95330	76	2mo		
3	▼1	mgchbot		  	0.95327	79	2mo		
4	▼1	[ods.ai] BRAIZ		    	0.95305	148	2mo		
5	▲3	[ods.ai] resnet34		 	0.95249	180	2mo		
6	▲1	ORNITORRINCO		   	0.95150	85	2mo		
7	▼1	bestfitting			0.95143	102	2mo		
8	▲4	Aleksey Nozdryn-Plotnicki			0.95101	46	2mo		
9	▲2	 Labradoodle		 	0.95093	189	2mo		
10	—	Across the Pacific Ocean		    	0.95093	291	2mo		
11	▼6	JNU Multimedia and Image P...		   	0.95037	289	2mo		
12	▲7	Shakeup Monster		   	0.94994	235	2mo		
13	▼4	outrunner			0.94989	65	2mo		
14	—	pudae			0.94974	29	2mo		
15	▲2	ShakeupNet V2		 	0.94958	96	2mo		



Can a neural network learn to recognize doodling?

Help teach it by adding your drawings to the [world's largest doodling data set](#), shared publicly to help with machine learning research.

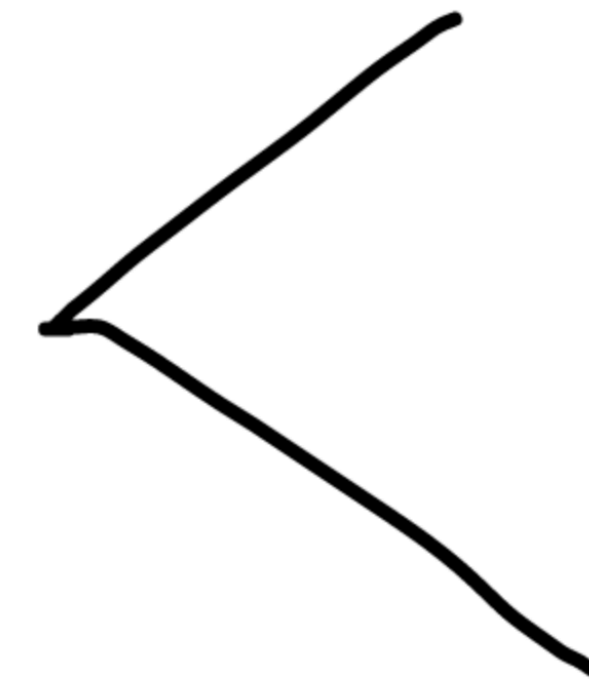
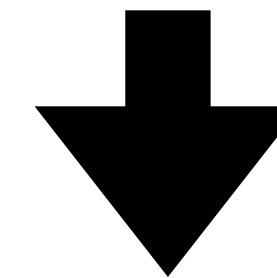
Let's Draw!



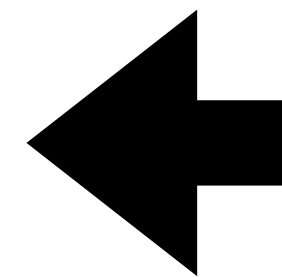
Drawing 1/6

Draw
zigzag
in under 20 seconds

Got It!

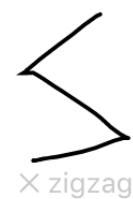


I see arrow, eraser, crayon



Well drawn!

Our neural net figured out 4 of your doodles.
But it saw something else in the other 2.
Select one to see what it saw, and visit the [data](#) to see 50 million drawings made by other real people on the internet.



× zigzag



✓ frog



✓ bench



× leaf



✓ mountain



✓ firetruck

Data

Train Set: 49.707.579

Test Set: **112.199**

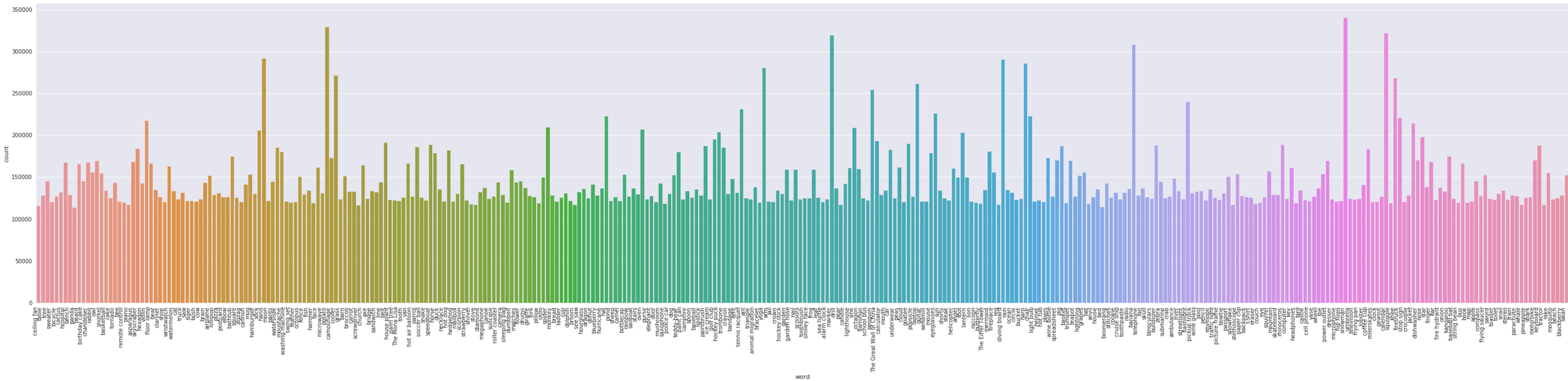
Classes: **340**

Format:

```
{  
  "key_id": "5891796615823360",  
  "word": "nose",  
  "countrycode": "AE",  
  "timestamp": "2017-03-01 20:41:36.70725 UTC",  
  "recognized": true,  
  "drawing": [[[129, 128, 129, 129, 130, 130, 131, 132, 132, 133, 133, 133, 133, ...]]]  
}
```

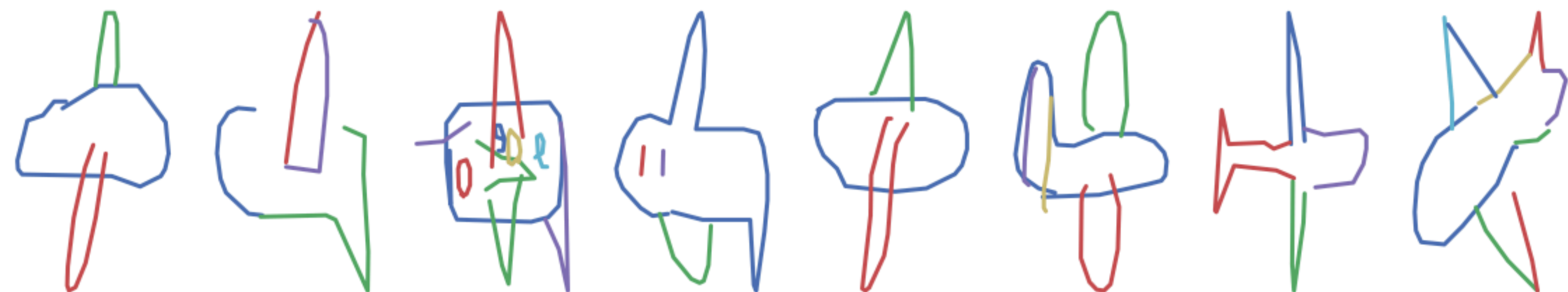
```
[  
  [  
    // First stroke  
    [x0, x1, x2, x3, ...],  
    [y0, y1, y2, y3, ...],  
    [t0, t1, t2, t3, ...]  
  ],  
  [  
    // Second stroke  
    [x0, x1, x2, x3, ...],  
    [y0, y1, y2, y3, ...],  
    [t0, t1, t2, t3, ...]  
  ],  
  ... // Additional strokes  
]
```

Data

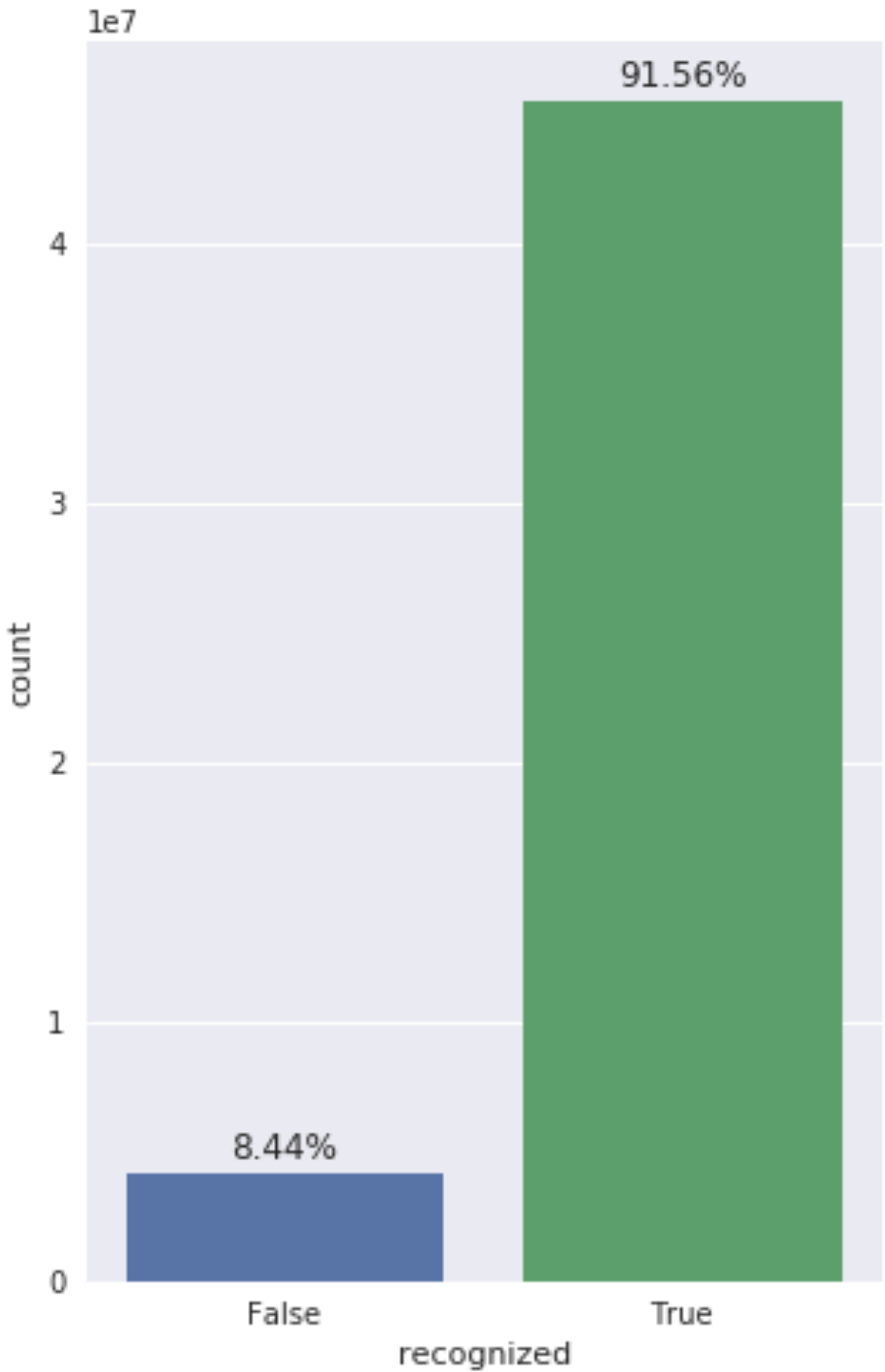


Data

Recognized (airplane)



Not recognized (airplane)



Evaluation

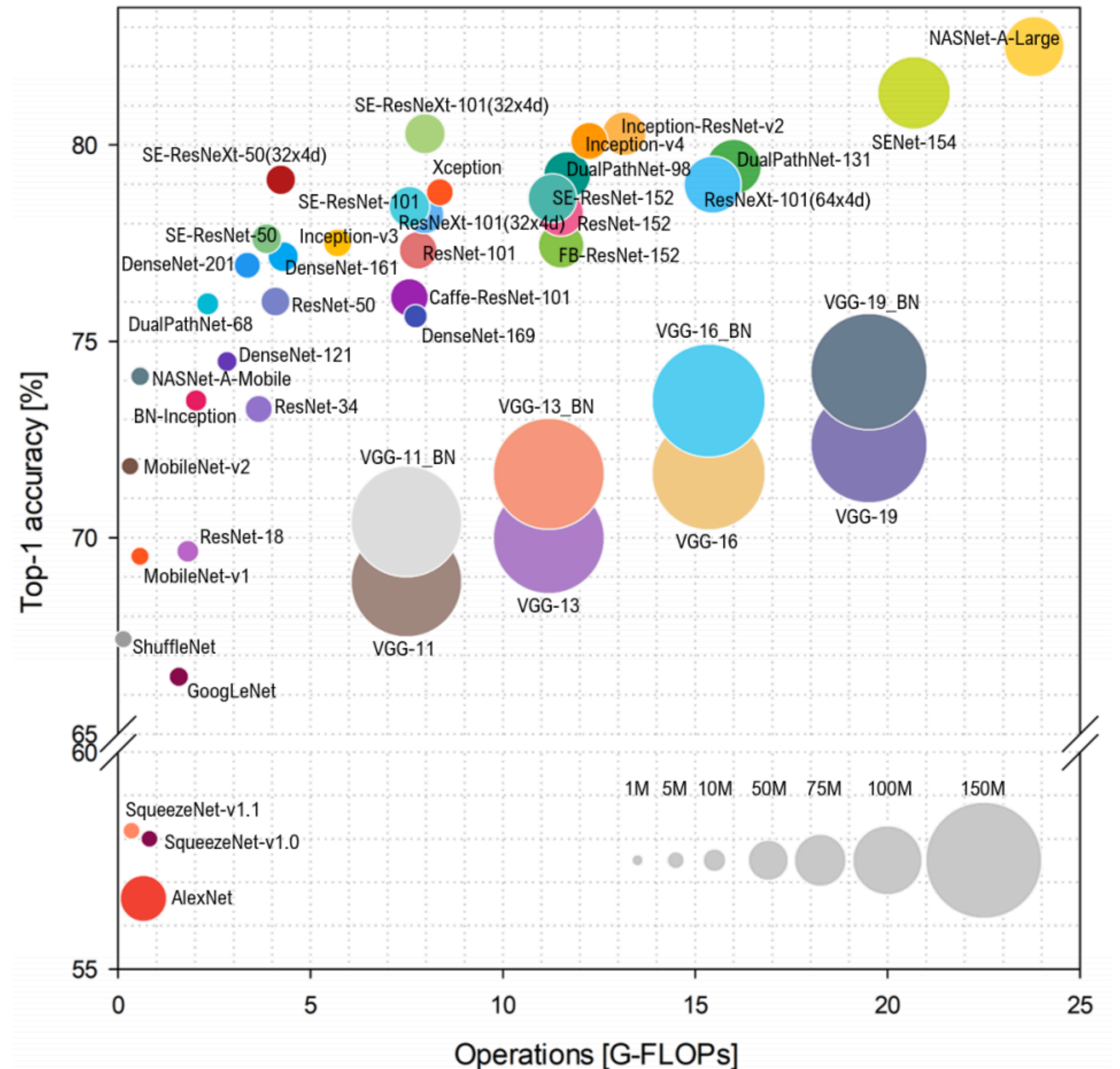
Mean Average Precision @ 3 (MAP@3):

$$MAP@3 = \frac{1}{U} \sum_{u=1}^U \sum_{k=1}^{\min(n,3)} P(k)$$

where U is the number of scored drawings in the test data,
 $P(k)$ is the precision at cutoff k , and n is the number predictions per drawing.

Models

- PNASNet-5-Large
- SENet154
- SE-ResNeXt101_32x4d
- SE-ResNeXt50_32x4d
- ResNet50
- DenseNet121



Training

- Models pre-trained on ImageNet
- Cosine Annealing with Warm Restarts
- Reduce Learning Rate on Plateau
- Don't Decay the Learning Rate, Increase the Batch Size
- Pseudo Labeling
- Size: 128x128, 160x160, 192x192, 224x224
- Optimizer: SGD, Adam
- **Single Model Score:** 0.941 - 0.946 Public LB

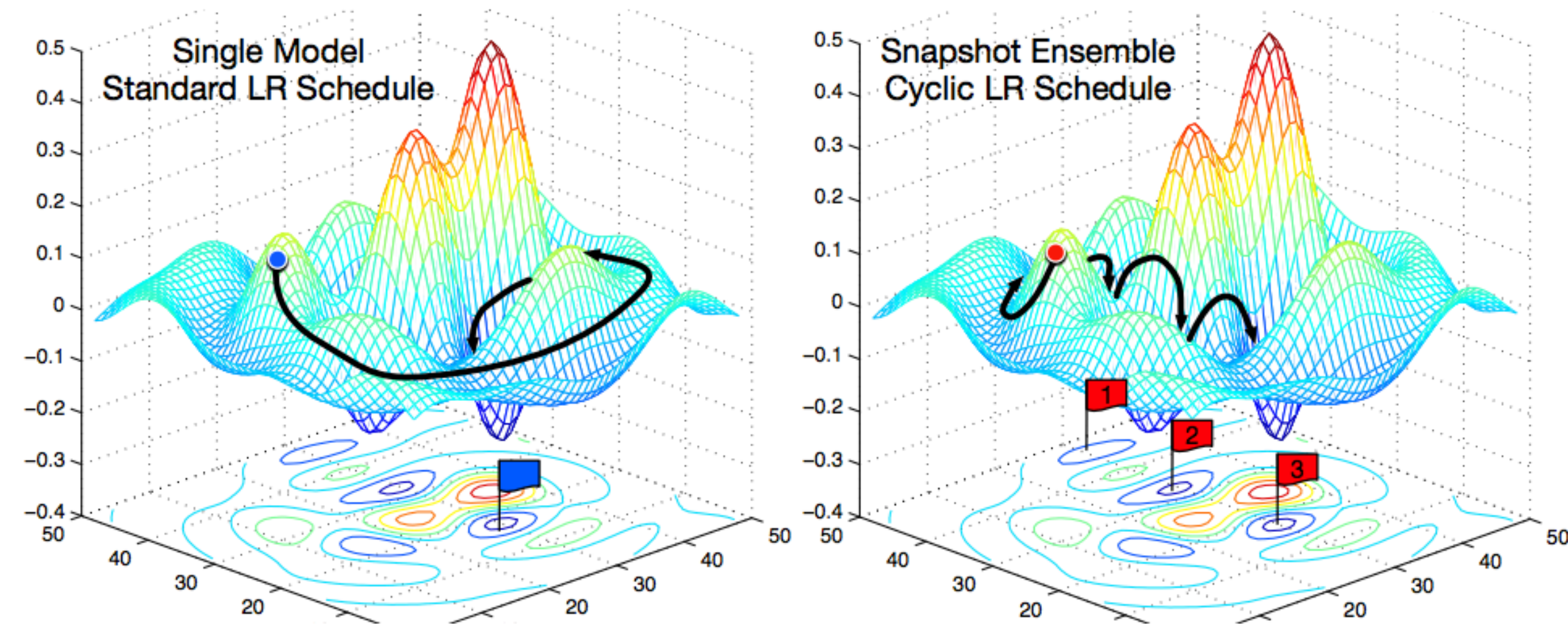
Training

- Models pre-trained on ImageNet
- Cosine Annealing with Warm Restarts
- Reduce Learning Rate on Plateau
- Don't Decay the Learning Rate, Increase the Batch Size
- Pseudo Labeling
- Size: 128x128, 160x160, 192x192, 224x224
- Optimizer: SGD, Adam
- **Ensemble Score:** 0.95143 Public LB

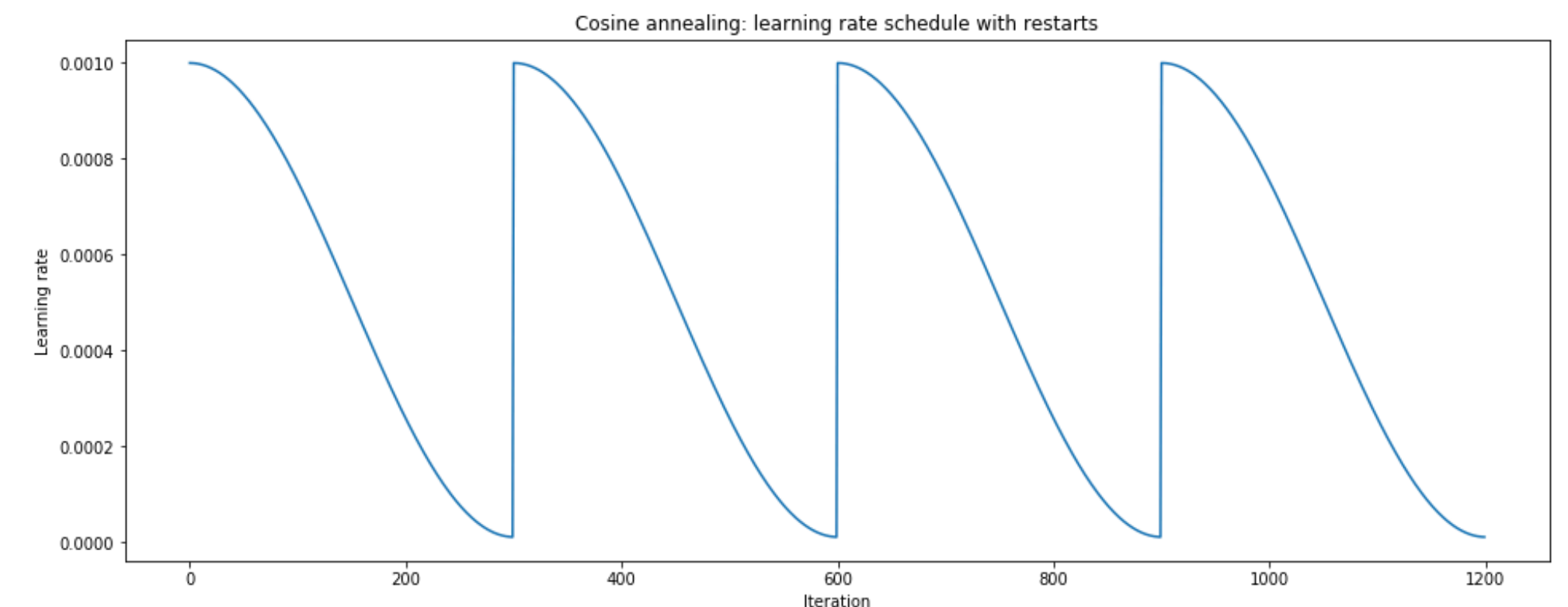
Training

- Models pre-trained on ImageNet
- Cosine Annealing with Warm Restarts
- Reduce Learning Rate on Plateau
- Don't Decay the Learning Rate, Increase the Batch Size
- Pseudo Labeling
- Size: 128x128, 160x160, 192x192, 224x224
- Optimizer: SGD, Adam
- **Final Score:** 0.95463 Public LB

Stochastic Gradient Descent with Warm Restarts



$$\eta_t = \eta_{\min}^i + \frac{1}{2} (\eta_{\max}^i - \eta_{\min}^i) \left(1 + \cos \left(\frac{T_{\text{current}}}{T_i} \pi \right) \right)$$



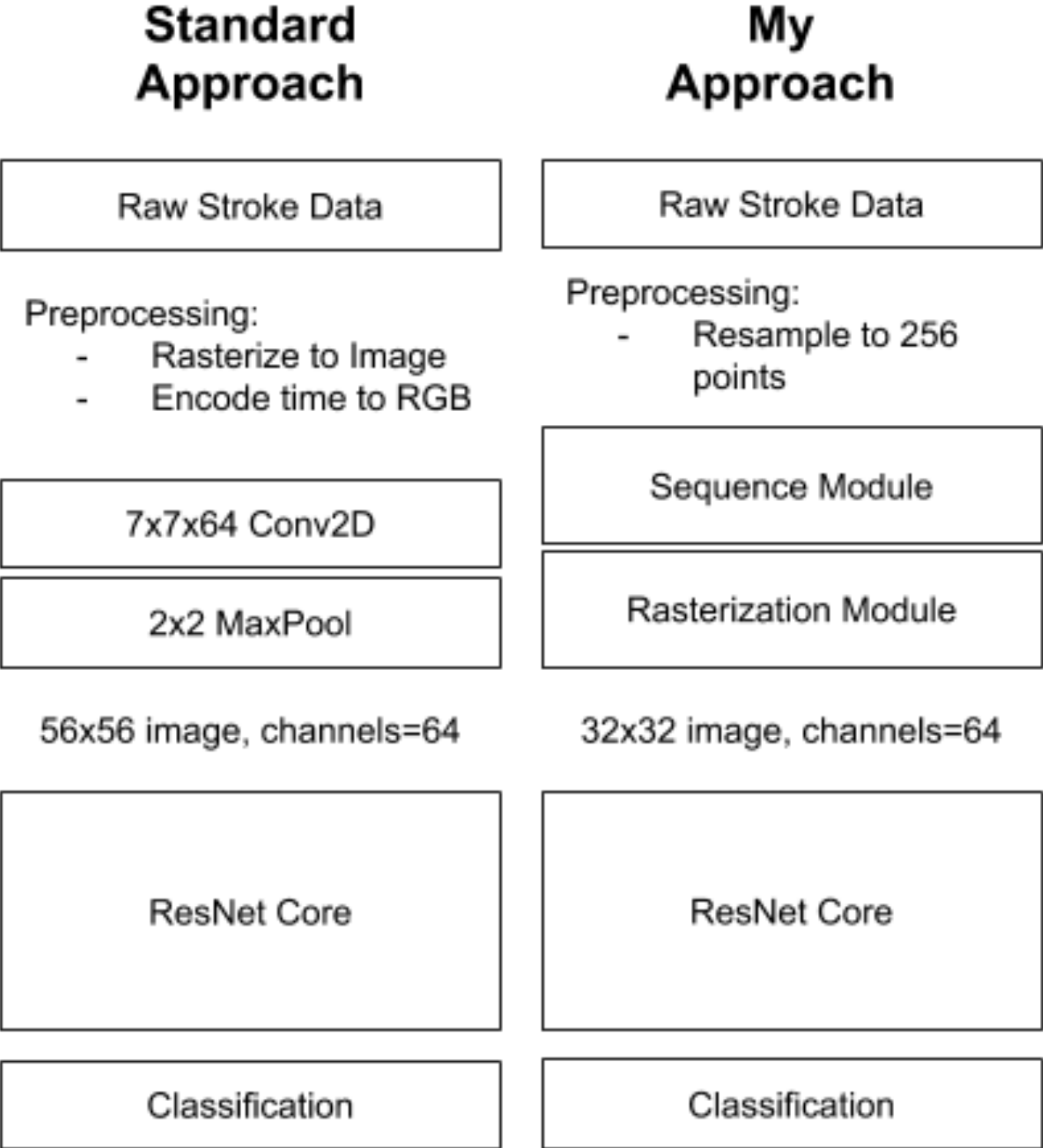
Proxy Score

Public LB	Proxy
0,933	8495
0,941	8093
0,945	6735
0,946	7621
0,947	7397
0,949	7121
0,950	6957
0,951	6647

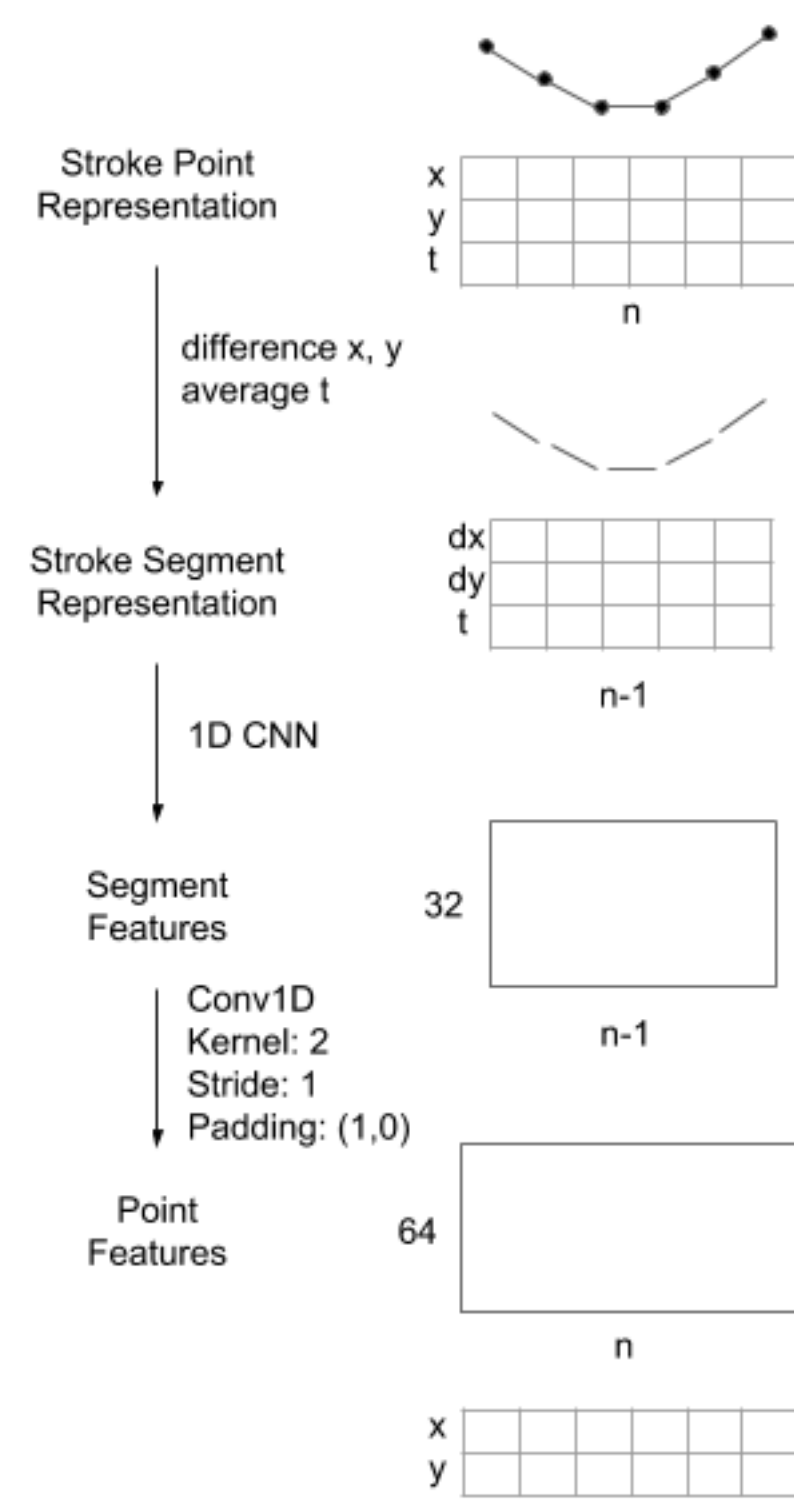


**KEEP
CALM
AND
BALANCE
YOUR PREDICTIONS**

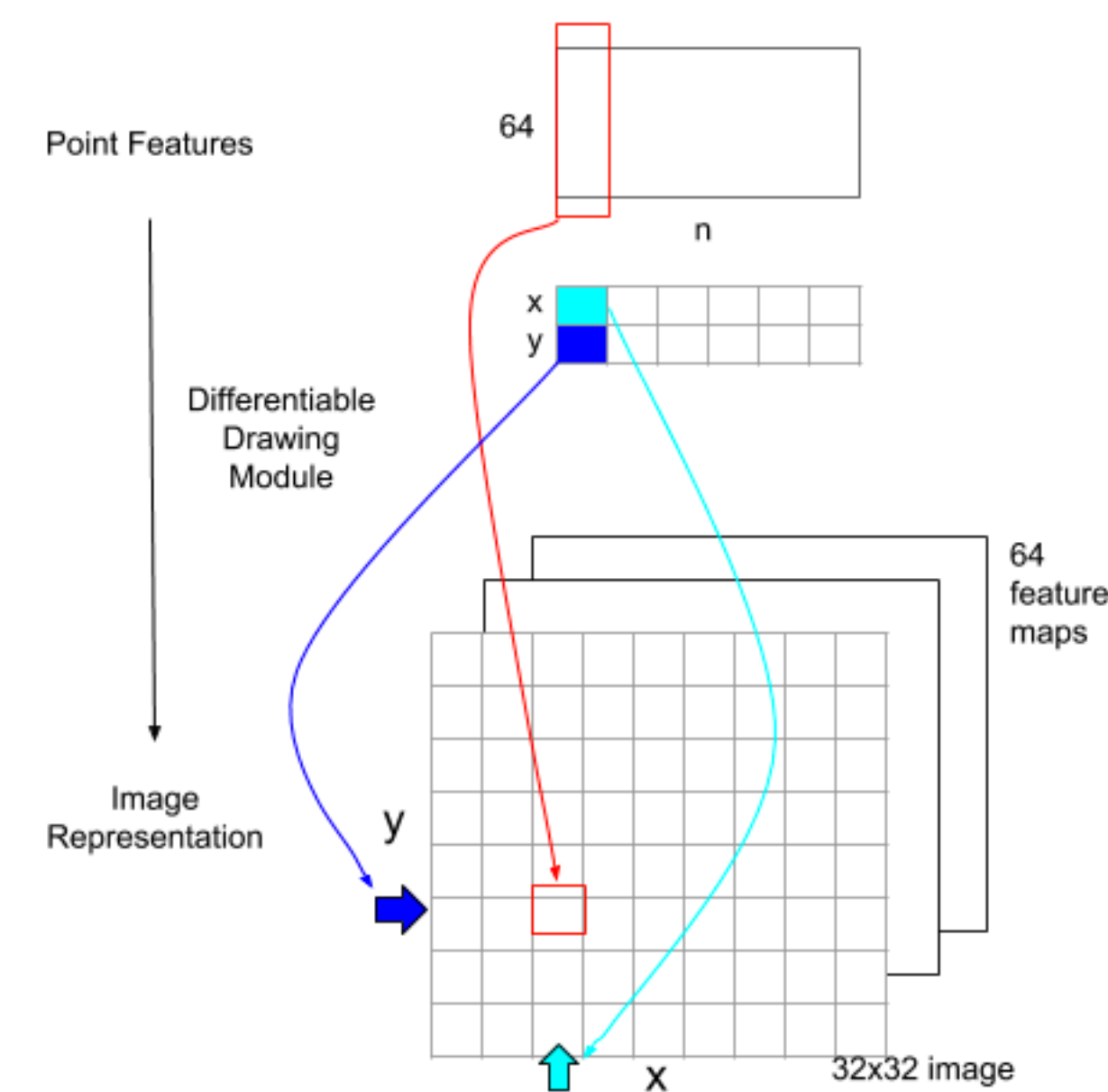
8th Place Solution (Aleksy Nozdryn-Plotnicki)



Sequence Module



Rasterization Module



**Thank you for your
attention!**