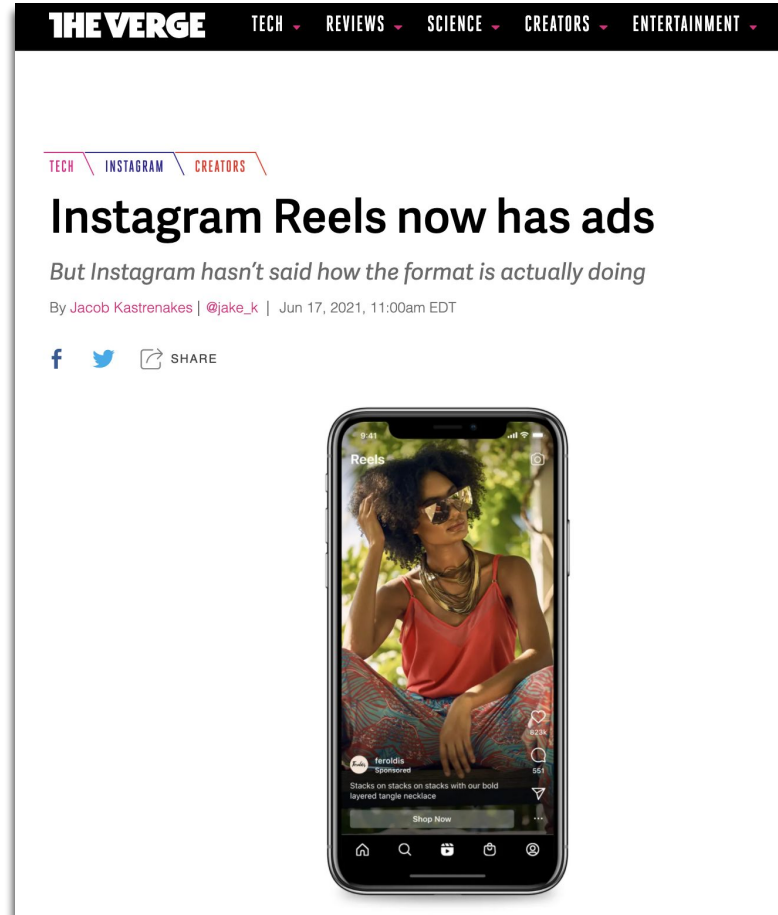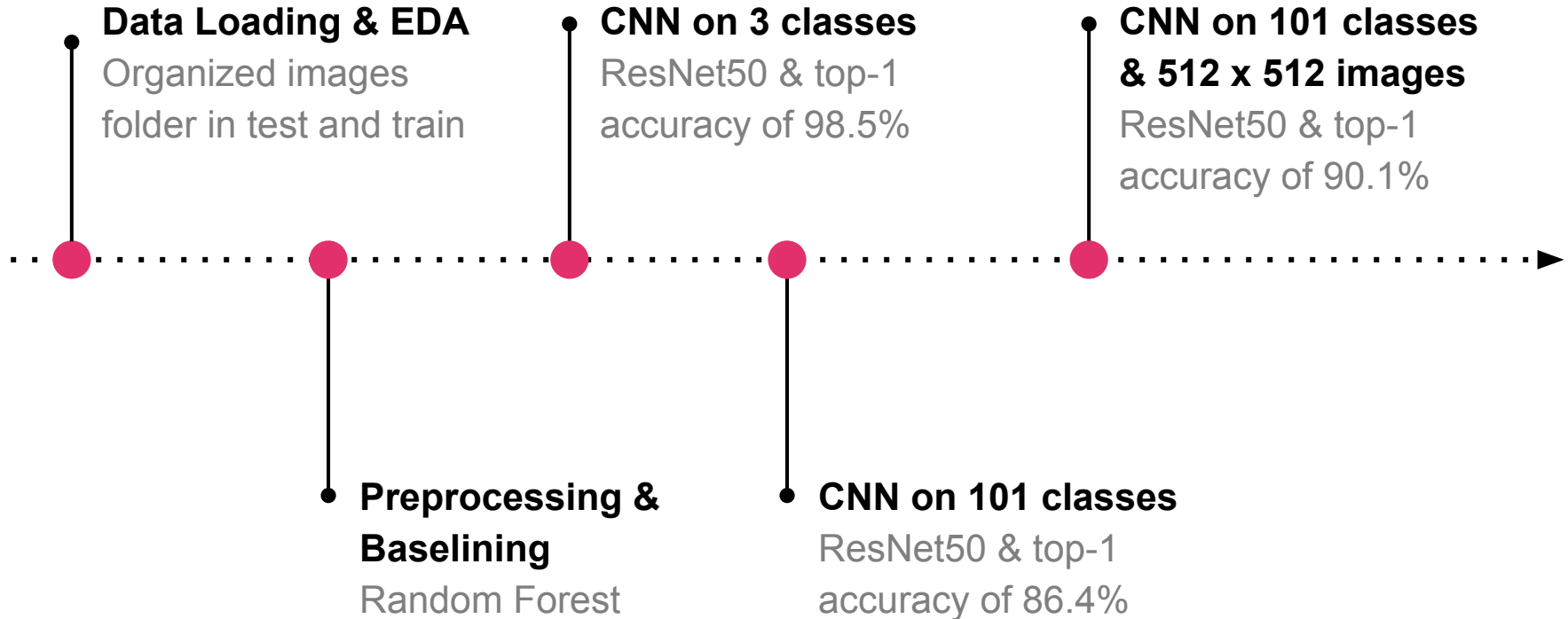# Instagram | Deep Targeting

Opportunity

Objective: increase Instagram's Ad Revenues

Impact Hyp: equipped with a more advanced targeting algorithm, advertisers will boost their revenues and, in turn, increase marketing spend on Instagram

Methodology

Data Loading & EDA
Organized images
folder in test and train

CNN on 3 classes
ResNet50 & top-1
accuracy of 98.5%

**CNN on 101 classes
& 512 x 512 images**
ResNet50 & top-1
accuracy of 90.1%

**Preprocessing &
Baselining**
Random Forest

CNN on 101 classes
ResNet50 & top-1
accuracy of 86.4%

CNN INPUTS
ResNet50 Transfer Learning

Data Challenges

Scope: Food-101 dataset

Images: 101,000 in total and 1,000 per class
- 750 in train set
- 250 in test set

Classes: 101 food classes

Noise embedded by design
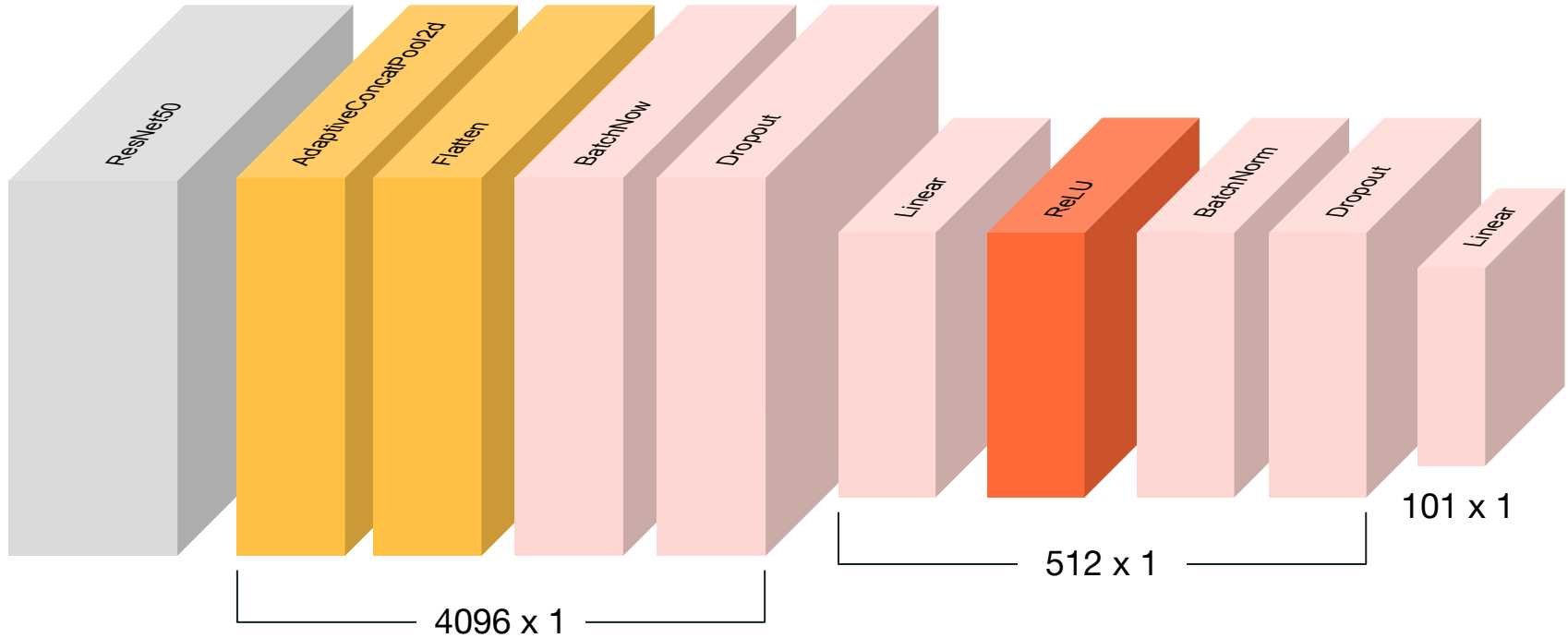
Poor image quality

Multi-class images

In-class variability

Intra-class similarity

CNN Architecture based on ResNet50

Transformations

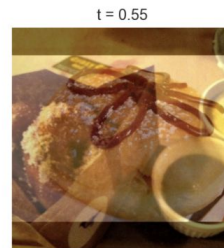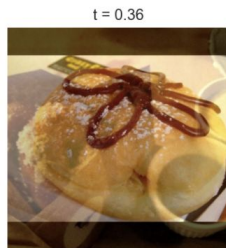**Composite Image Augmentation** to boost model generalizability

- Dihedral Affine Transformation
- Symmetric Warp
- Rotation
- Zoom
- Brightness
- Contrast

Transformations

Mixup Image Augmentation by linearly interpolating between two images to create a new *augmented* image

- t is the weight assigned to one image
- t from beta distribution with $0 \leq \alpha \leq 0.4$
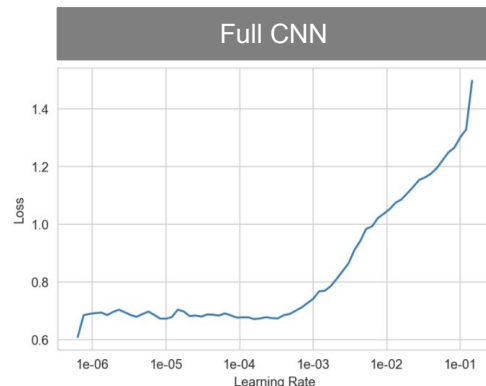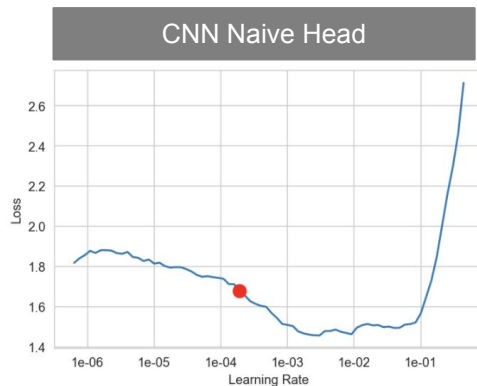
Fine-tuning

One Cycle Policy

- Schedule for learning rate and momentum leads to faster convergence and better generalization
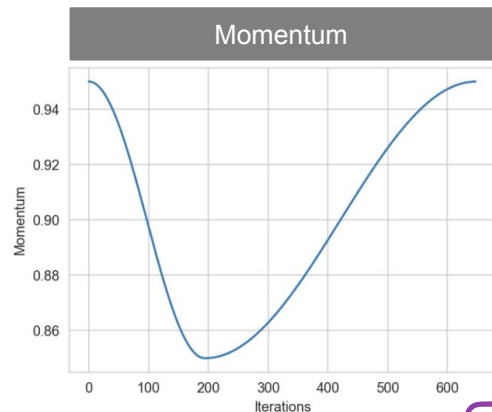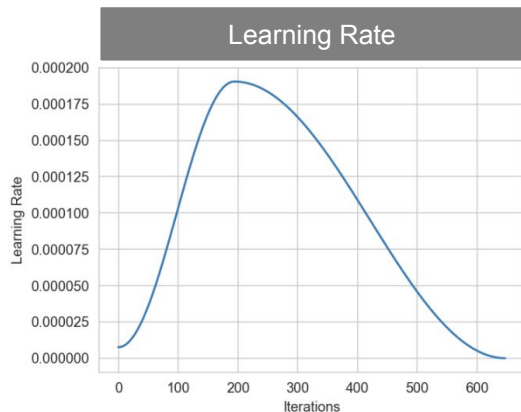
Discriminative Learning Rates

- Different learning rates for different parts of the model

One Cycle Policy

Discriminative Learning Rates

CNN OUTPUTS
Food-101 Image Classifier
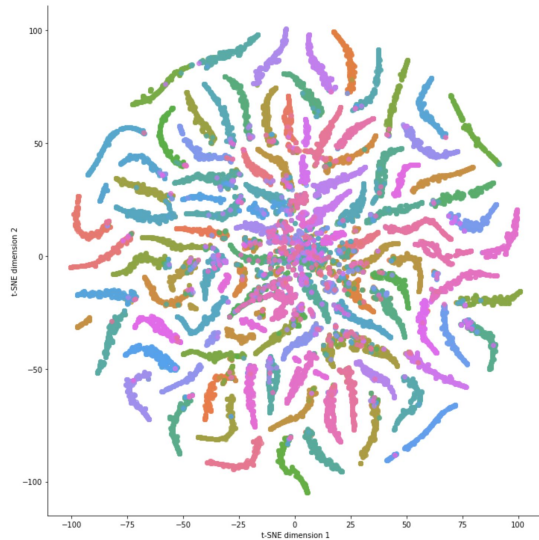
Most Confused

Top 9 classes

Too similar image classes impact model accuracy

- Steak & related meats
- Chocolate-based desserts
- Other desserts

|	Actual	Predicted	# Occurrences
	Steak	Filet Mignon	11
	Chocolate Mousse	Chocolate Cake	10
	Cheesecake	Strawberry Shortcake	9
	Dumplings	Gyoza	9
	Onion Rings	Fried Calamari	8
	Prime Ribs	Filet Mignon	8
	Tiramisu	Chocolate Mousse	8
	Chocolate Cake	Chocolate Mousse	7
	Filet Mignon	Steak	7

t-SNE plots of food classes

All 101 food classes
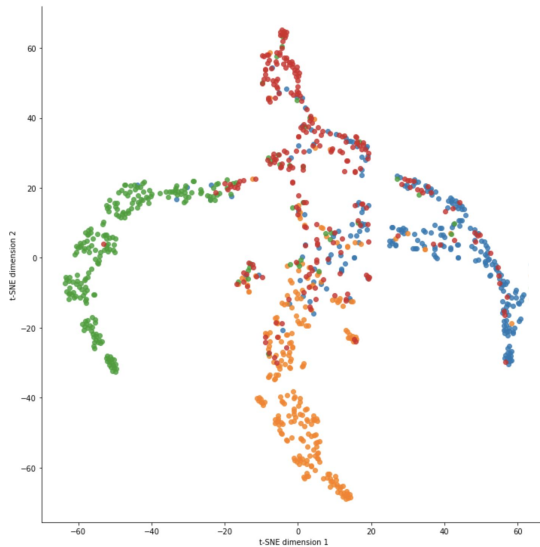
Most confused food classes (i.e., steak, filet mignon, prime rib, pork chop)
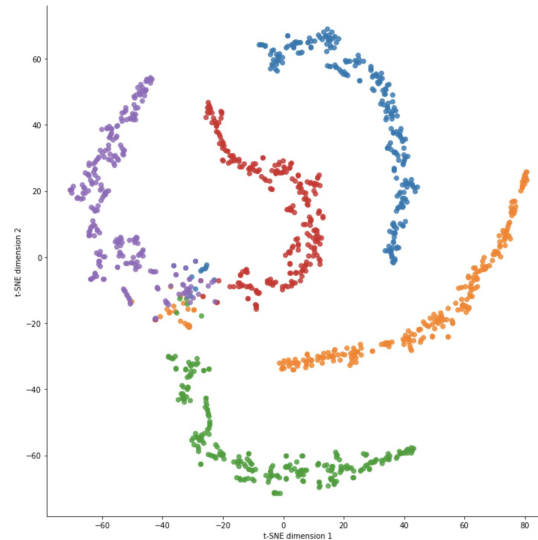
Highly separable food classes (i.e., cup cakes, creme brulee, fried rice, caesar salad, lasagna)

Summary Metrics

Food-101 CNN based on ResNet50

0.901

Top-1 Accuracy

0.984

Top-5 Accuracy

Where do we go from here?

- **Text Classification:** apply RNN to classify Instagram image caption; combine this output with the CNN image classification output to boost model accuracy

- **Recommendation Engine**: identify similar dishes to the one shared by the user so as to unlock new targeting opportunities for other advertisers

- **Other categories:** scale the algorithm to other categories of user generated content (e.g. clothing items, accessories) so as to build a true user-driven and user-specific targeting engine for advertisers

Questions?