**Single Image GAN Group Meeting Notes (2020-05-25)**

**Paper Title:** Data Augmentation from a Single Image

**Attendees:** Dennis McWherter, Zelin Li Aiden Zhang, Yihao Li, Andy Guo, Uzay, Yusheng

**High-level Discussion Questions**

* Team-level primary paper contribution (one sentence description):
  + Group 1: Applying SinGAN as a data augmentation technique and comparing against other GAN-based methods (BAGAN, DAGAN). Secondary: representative selection.
  + Group 2: Data Augmentation using SinGAN compared against simple data Aug methods
  + Group 3: Applying SinGAN as a data aug method in extremely imbalanced dataset against BAGAN and geometric transformation, using ResNet as the evaluation metric. Secondary: SinGAN structural hyperparameter analysis.
* Ignoring resource constraints, how would we merge these contributions into an “ideal” paper on the topic? If possible, let’s try to stay within the parameters of the current abstract to reduce the amount of new work required.
  + Outline:
  + Dataset Preparation
    - How to imbalance-- justified decisions: BAGAN’s imbalance pipeline: (i) Do it across all classes, (ii) Do it for different proportions, (iii) Do it for different datasets.
  + Dataset Augmentation
    - Effect of representative selection
    - Generate samples using single image GAN (SinGAN, ConSinGAN)
  + Method:
    - Augment dataset
    - Train a network based on augmented dataset (i.e. MobileNet or ResNet)
    - Evaluate results
  + Analysis
    - Diversity of SinGAN output vs. original dataset (SSIM?)
  + Results
    - Accuracy, performance ,etc.
* Do we have any contradictory evidence? Can we run an experiment(s) to help understand and resolve this conflict(s)?
  + Cats vs. dogs or koala’s vs. water towers-- the dataset we’re training on may have large impact on how well technique works.
  + Different evaluation networks (i.e. ResNet vs. Mobilenet) may have different results
    - Standardizing batch sizes across evaluation networks may help reduce
    - Consider a new network like EfficientNet
* Taking a step back from the ideal, what can we actually accomplish within the next 3-4 weeks? Is this lighter-weight contribution still value-add?
* Does this require any significant rework? Is that rework a worthwhile contribution?
  + Unify code contributions
  + Representative pipeline worth rework/reanalysis
  + Re-work dataset prep using BAGAN method
* Is representative selection a worthwhile callout? Preliminary tests show us that “random selection” produces similar generalized results and 1% lower class-specific results. Will we need to ultimately justify this process somehow? Perhaps this is a separate exploration if it’s not making a clear contribution.
* Do we need a more explainable method for inducing imbalance? Should we randomly imbalance all classes and augment them all to a fixed number?
* On high dropping ratios, performance of BAGAN is very poor. BAGAN generated images are identical(The diversity from 1 image is very low, but class diversity is inherited, which is a improvement from BAGAN)

**Notes**

* Generalized conclusion from group 3 is that default singan parameters work best.
* Group 2 trains on
* Training cats vs. dogs maybe harder problem than koala vs. water tower
  + Diversity of problem may have an affect on SinGAN generation ability for augmentation
* Group 1’s representative selection: DBSCAN + K-mean? Can be very exciting.
* SSIM comparison
* **Merge results (summary):**
  + All groups: same overall methodology (augment dataset, train, evaluate)
  + Group 1: representative selection (want to improve by using different embedding and clustering method rather than feature extraction and representative selection)
  + Group 2: increasing dataset and different learning problems may affect accuracy of approach
  + Group 3: structural analysis and provide data in fully trained data vs representative trained data

**Action Items**

* Pipeline
* Coding
* Training
* Yihao and Uzay will explore specific embedding and clustering details for subset selection
* Dennis unified code pipeline (in PyTorch)
* Uzay consider generating images that are more difficult to classify (extra exploration)