Preliminary Result: AI-Generated Neutrophil Image using Deep Convolutional GAN for Data Augmentation

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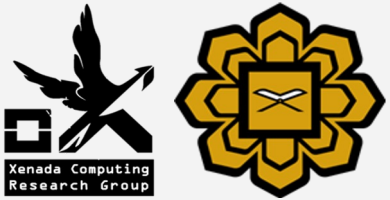

Hello!

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- Clinical Ai
- Generative Ai
- Creative Ai

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1. Data Augmentation

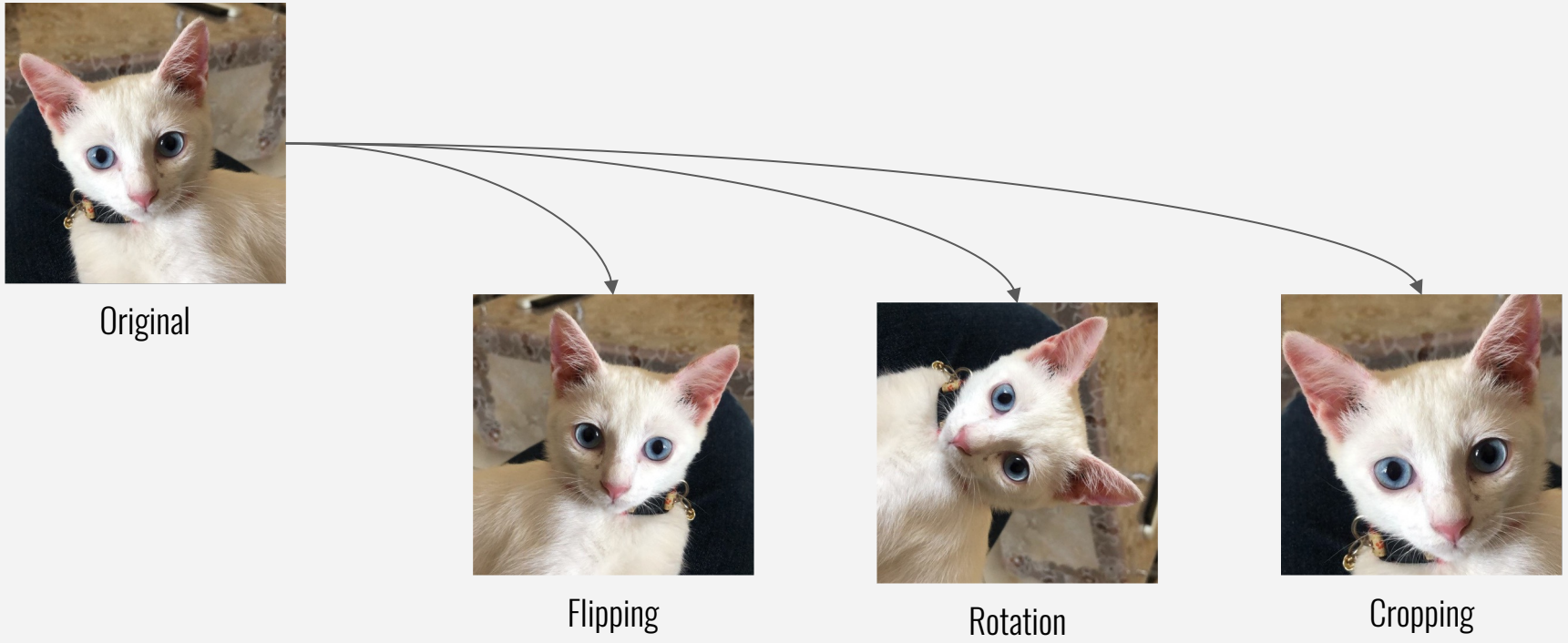
Data Augmentation

Techniques for increasing data volume by adding slightly changed copies of already existing data or newly created synthetic data.

Why Data Augmentation?

- Limited dataset especially on clinical image
- Patient data anonymization
- Optimizing medical analysis perfomance

Traditional Data Augmentation

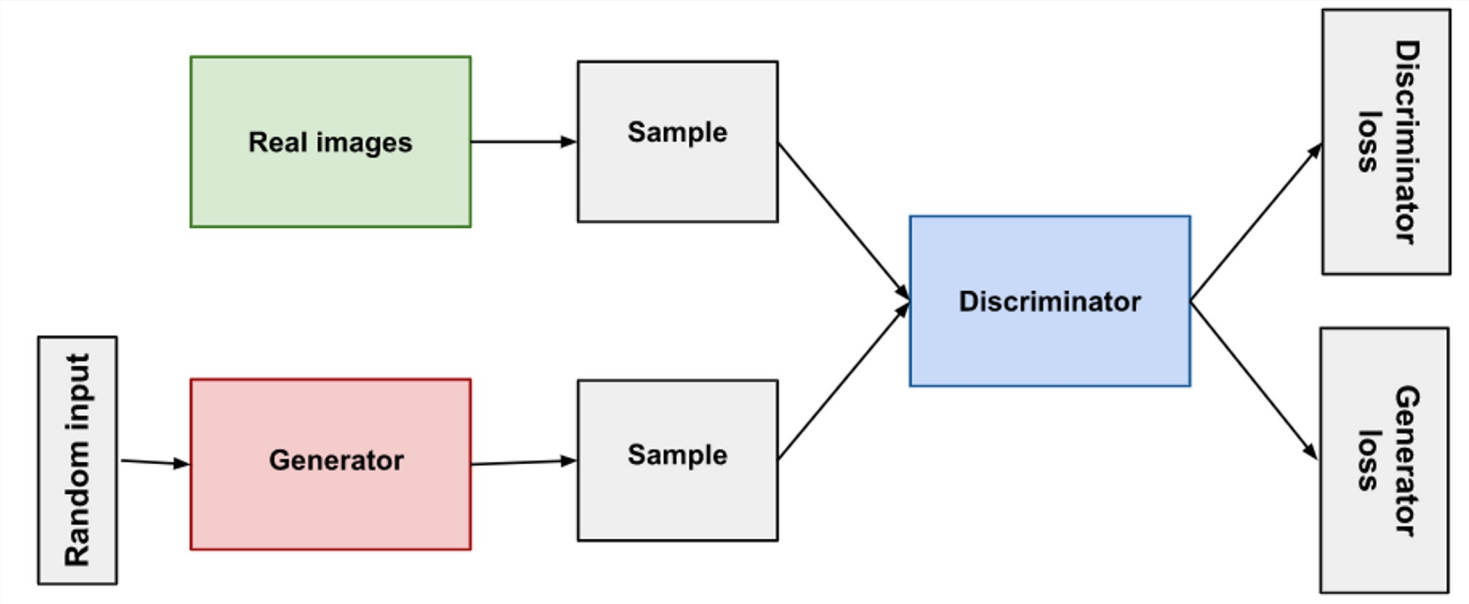


Advance Data Augmentation

- Neural Style Transfer

Advance Data Augmentation

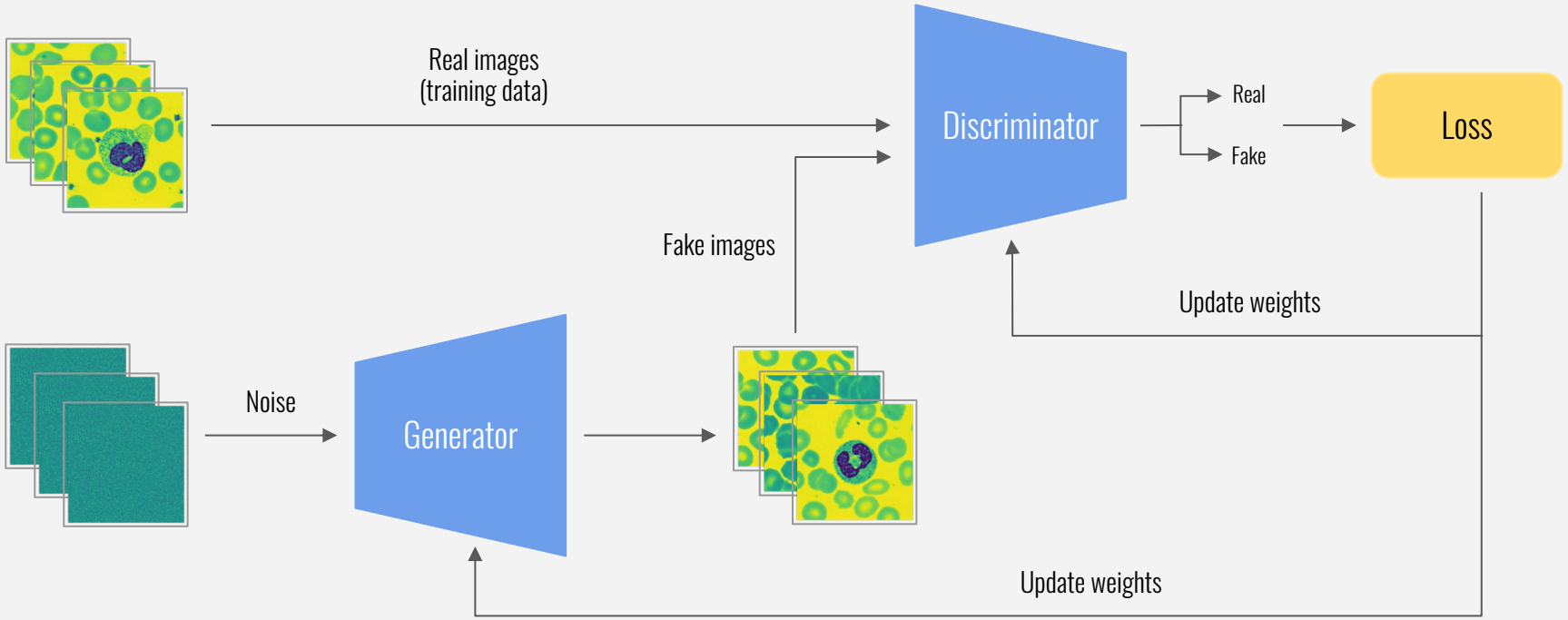
- Generative Adversarial Network (GAN)



2. The Experiment

The Architecture

Deep Convolutional Generative Adversarial Network(DCGAN)

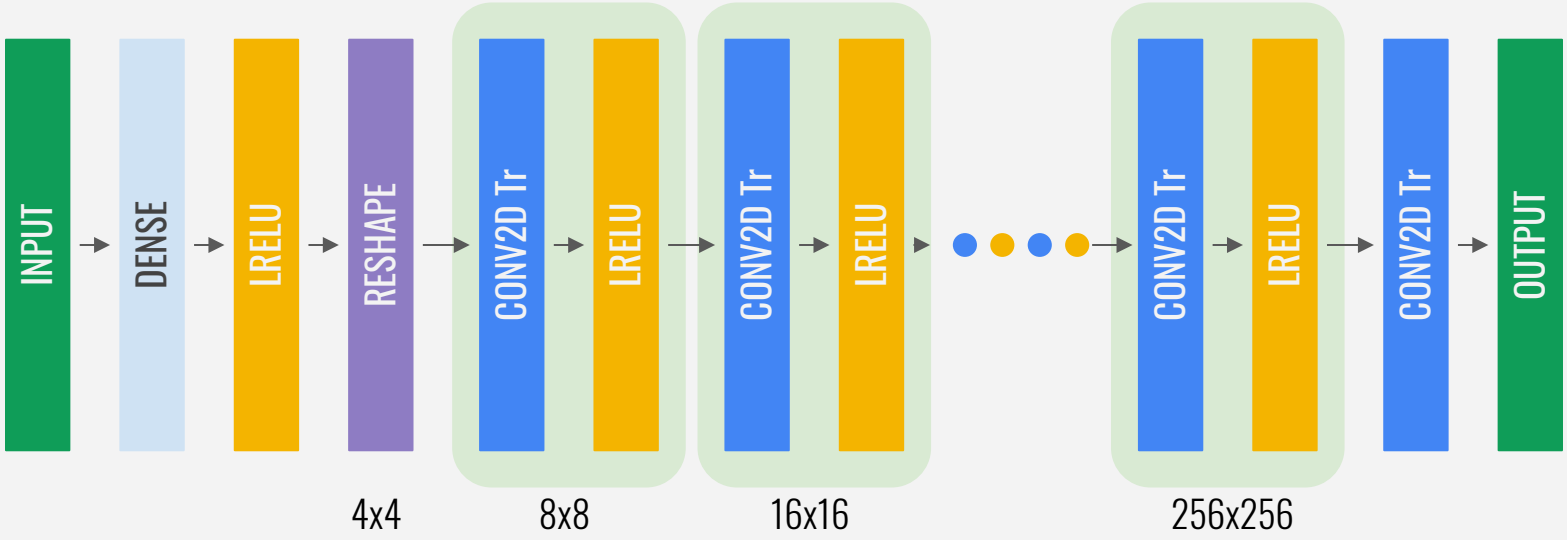


learns to generate plausible examples from the training dataset

simply a classifier, to distinguish between real images and fake images (generated by generator)

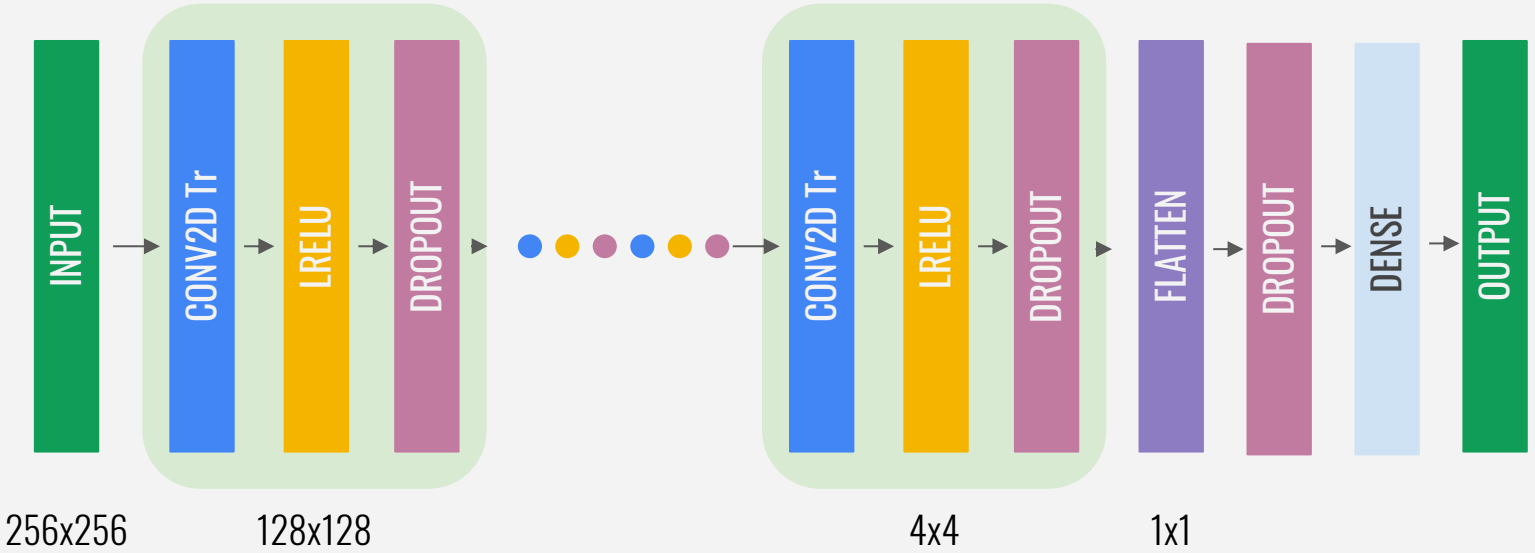
The Architecture

Generator



The Architecture

Discriminator



Hyperparameter

Loss Function: Binary Cross Entropy

Optimizer: Adam

Generator Learning Rate	Discriminator Learning Rate
0.0002	0.0002
0.0004	0.0003
0.0004	0.0004
0.0004	0.0002

Dataset

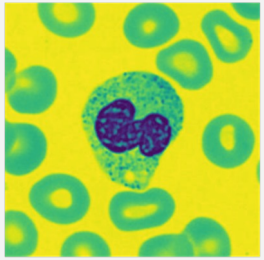
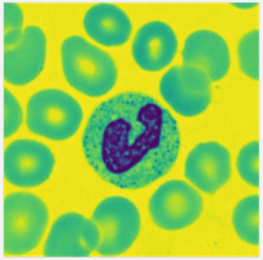
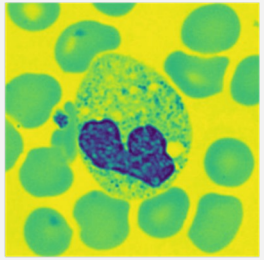
- Core Laboratory, Hospital Clinic of Barcelona
- Organized in groups of neutrophils, eosinophils, basophils, lymphocytes. monocytes, immature granulocytes
- 3329 neutrophil images for GAN training

ELSEVIER
Data in Brief

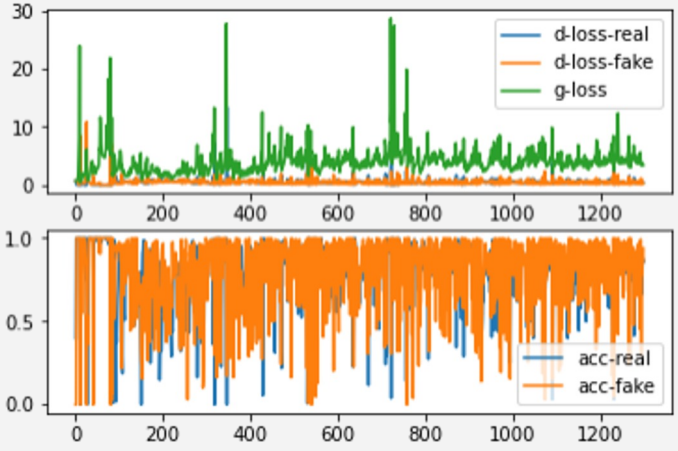
Data Brief. 2020 Jun; 30: 105474.
Published online 2020 Apr 8. doi: 10.1016/j.dib.2020.105474
PMCID: PMC7182702
PMID: 32346559

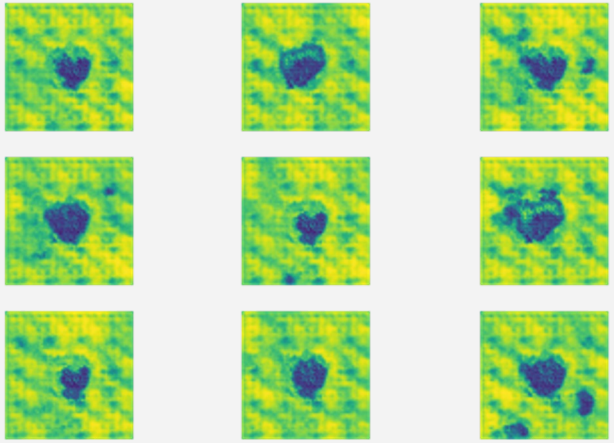
A dataset of microscopic peripheral blood cell images for development of automatic recognition systems

Andrea Acevedo,[a,b] Anna Merino,[a,*] Santiago Alférez,[c] Ángel Molina,[a] Laura Boldú,[a] and José Rodellar[b]

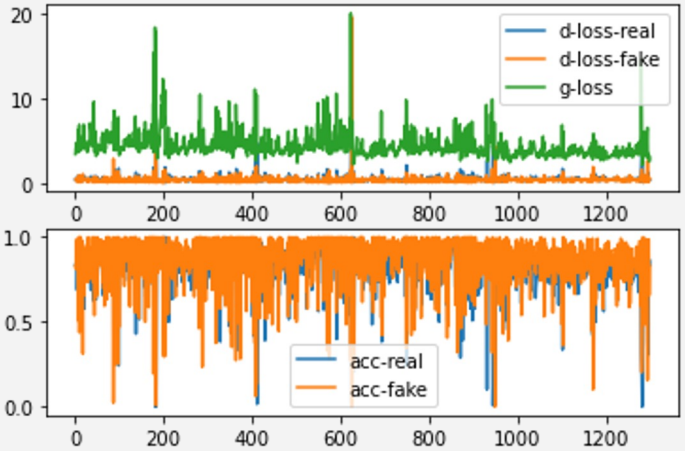
3. The Results

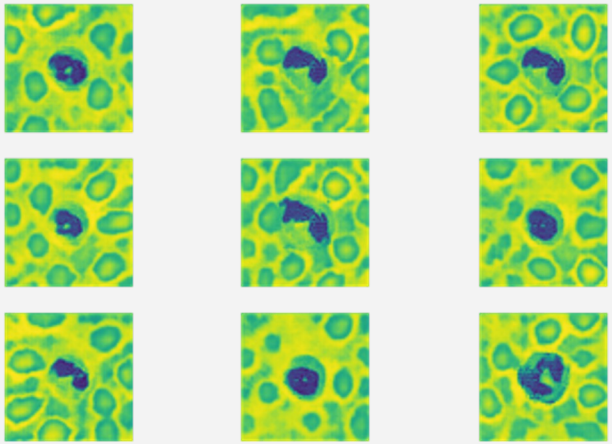




Gene LR	Disc LR
0.0004	0.0004

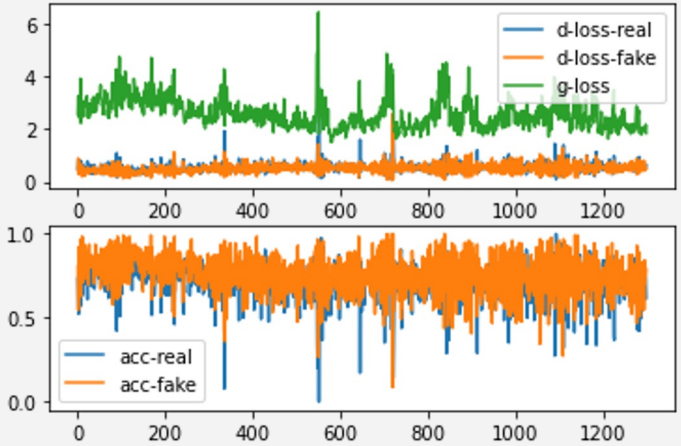
100 epochs

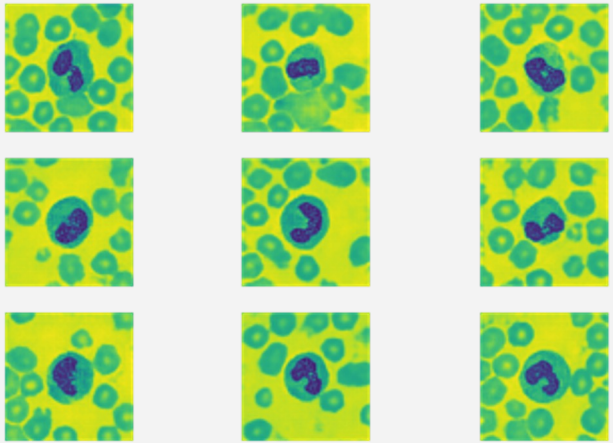




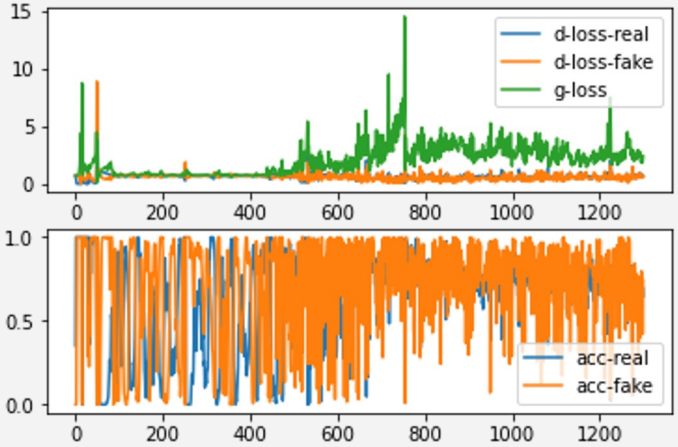
200 epochs

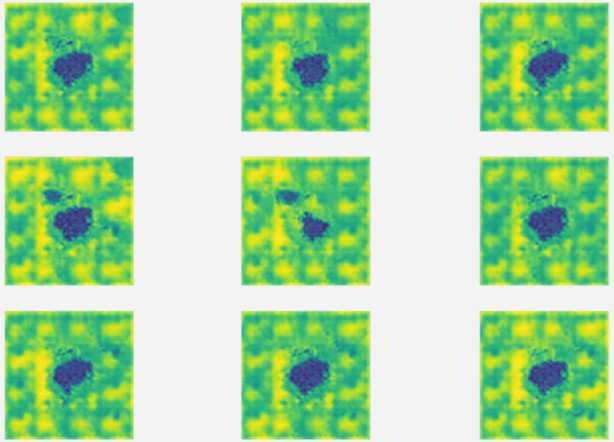
Gene LR	Disc LR
0.0004	0.0004





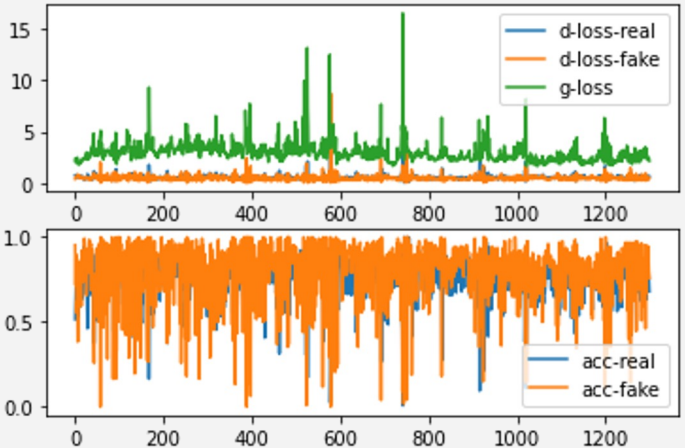
300 epochs

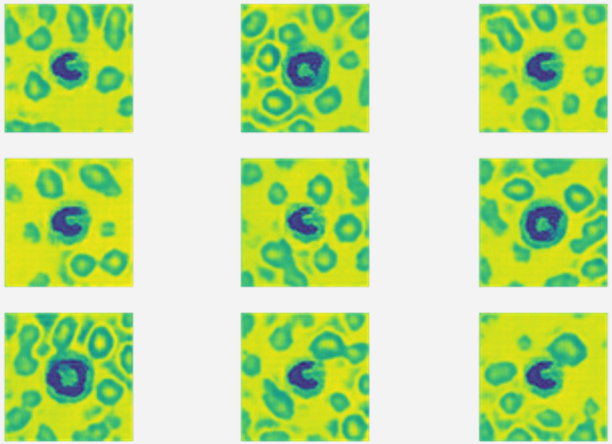




Gene LR	Disc LR
0.0004	0.0002

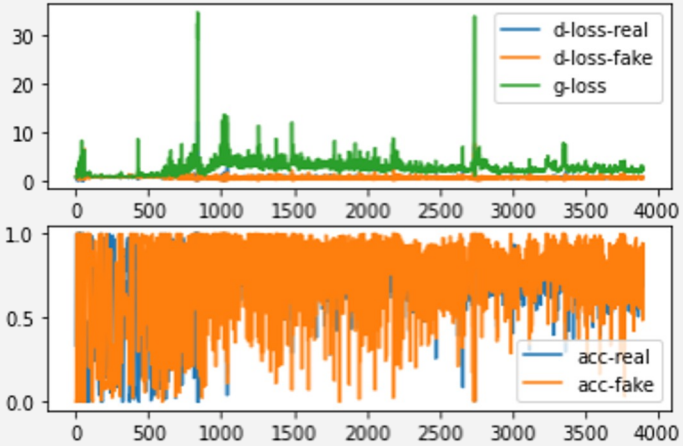
100 epochs

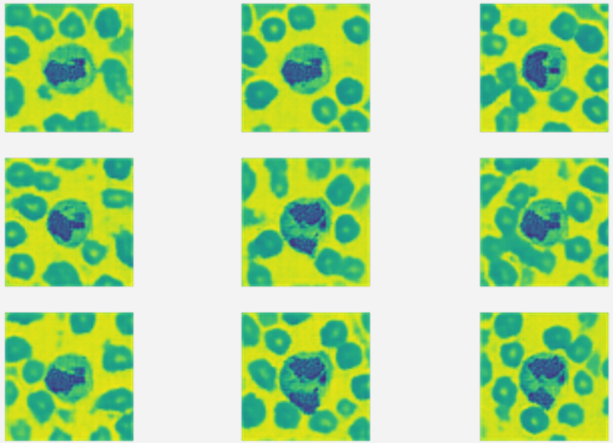




200 epochs

Gene LR	Disc LR
0.0004	0.0002

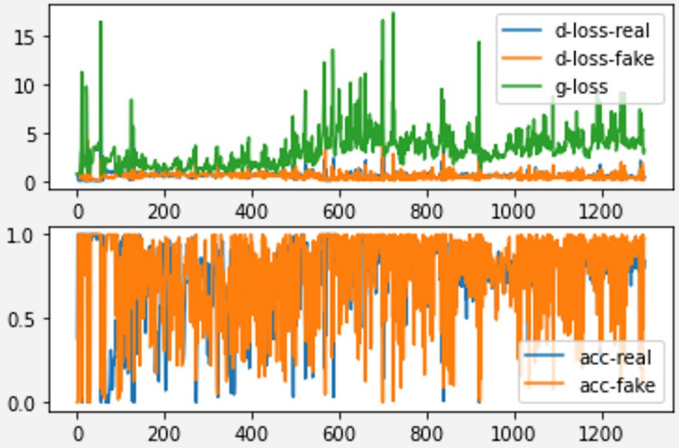


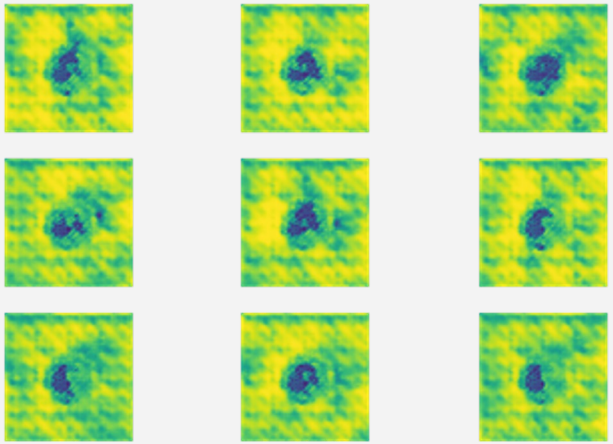


300 epochs

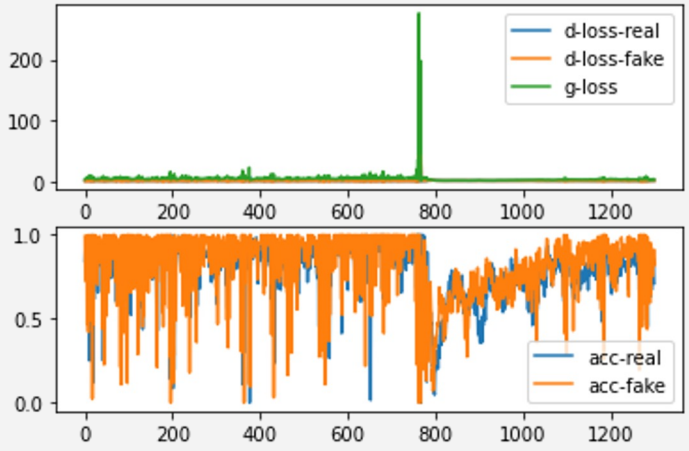
Mode Collapse

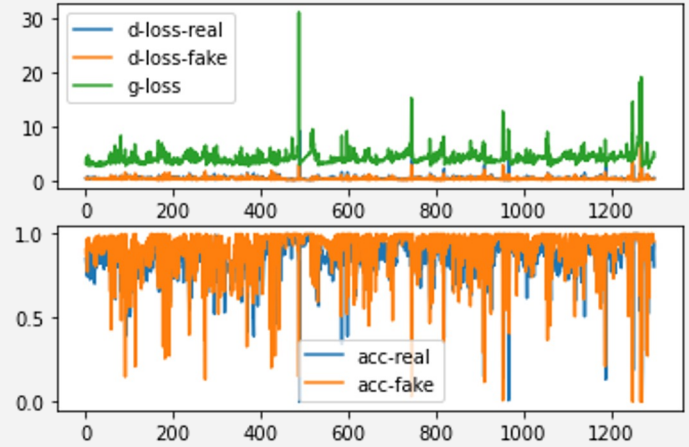
Gene LR	Disc LR
0.0004	0.0003

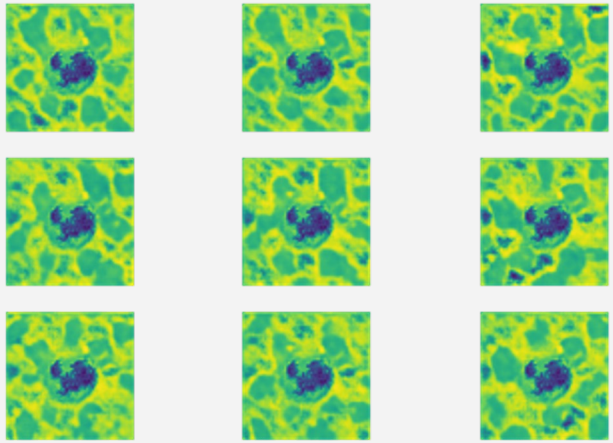


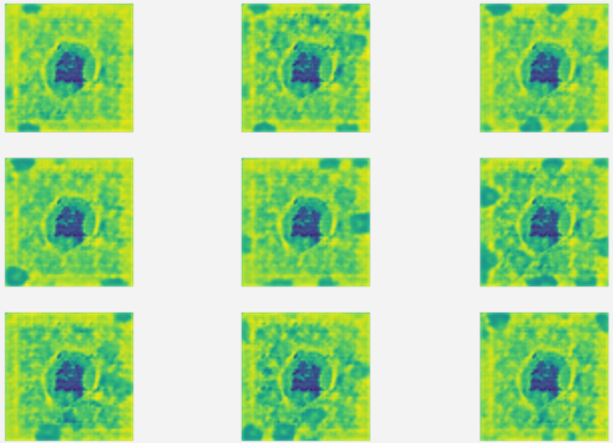


100 epochs









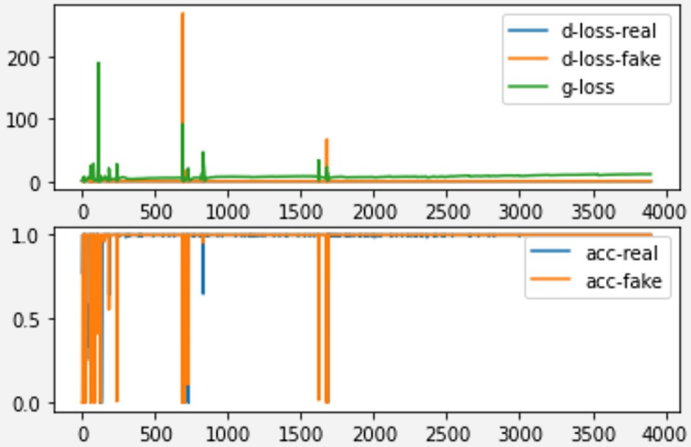
Gene LR	Disc LR
0.0004	0.0003

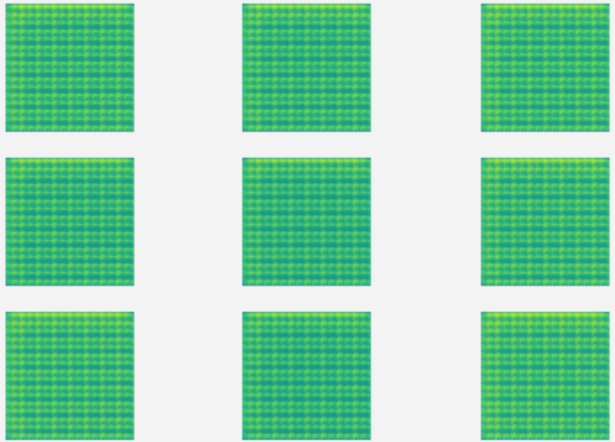
200 epochs

300 epochs

Failure to Converge

Gene LR	Disc LR
0.0002	0.0002

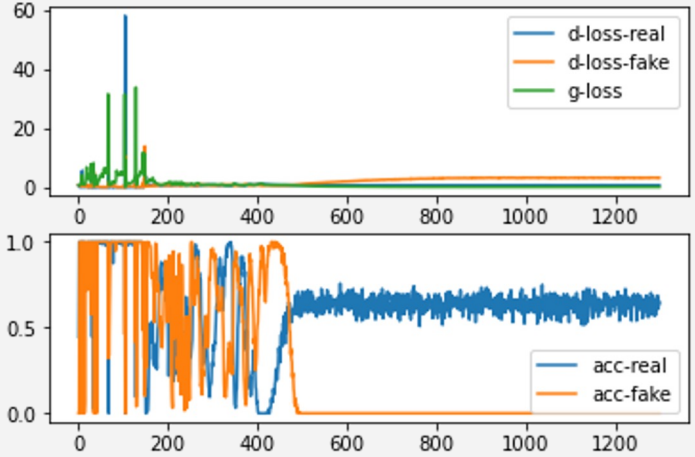


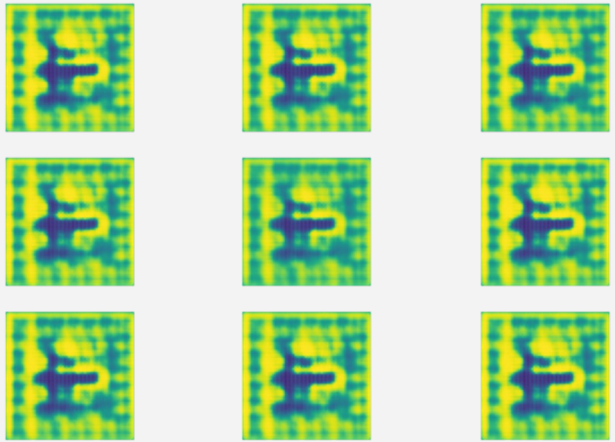


300 epochs

Failure to Converge

Gene LR	Disc LR
0.0004	0.0004
LR Scheduler: Cosine Decay	





300 epochs

Mode Collapse

Hypothesis: This is when the generator is over-optimize (too ‘smart’) compare to the discriminator, it will produce the same output which most plausible to the discriminator. The discriminator never manages to learn its way out of the trap.

Failure to Converge

Hypothesis: Due to the discriminator can not distinguish between the fake and real, its performance plummets. Its feedback gets less meaningful over time. This poses a convergence failure.

4. Conclusion

- The prelim results showed that DCGAN is a very sensitive model, as the small changes to the learning rate of both Generator and Discriminator will affect the training processes
- Generator with 0.0004 learning rate converge better
- Once GAN is collapsed, it will never manages to get out of the trap

Thank You
&
QnA