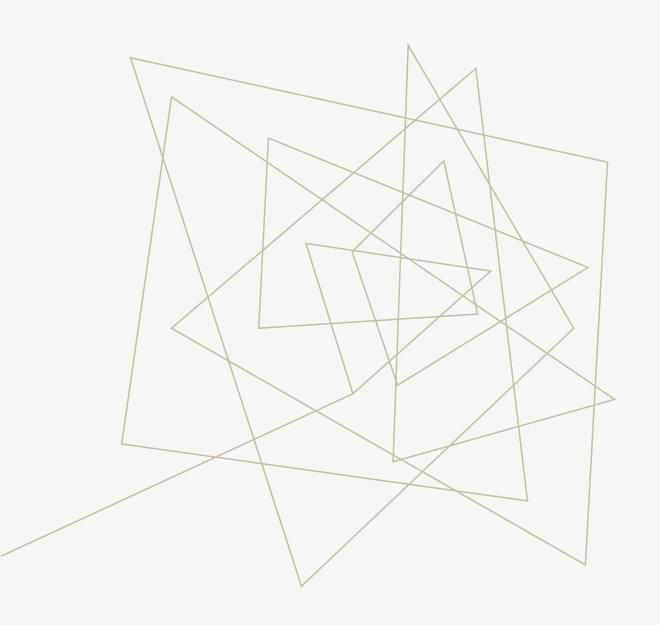
# HANDLING CLASS IMBALANCE BY GAN BASED DATA AUGMENTATION IN MEDICAL IMAGES

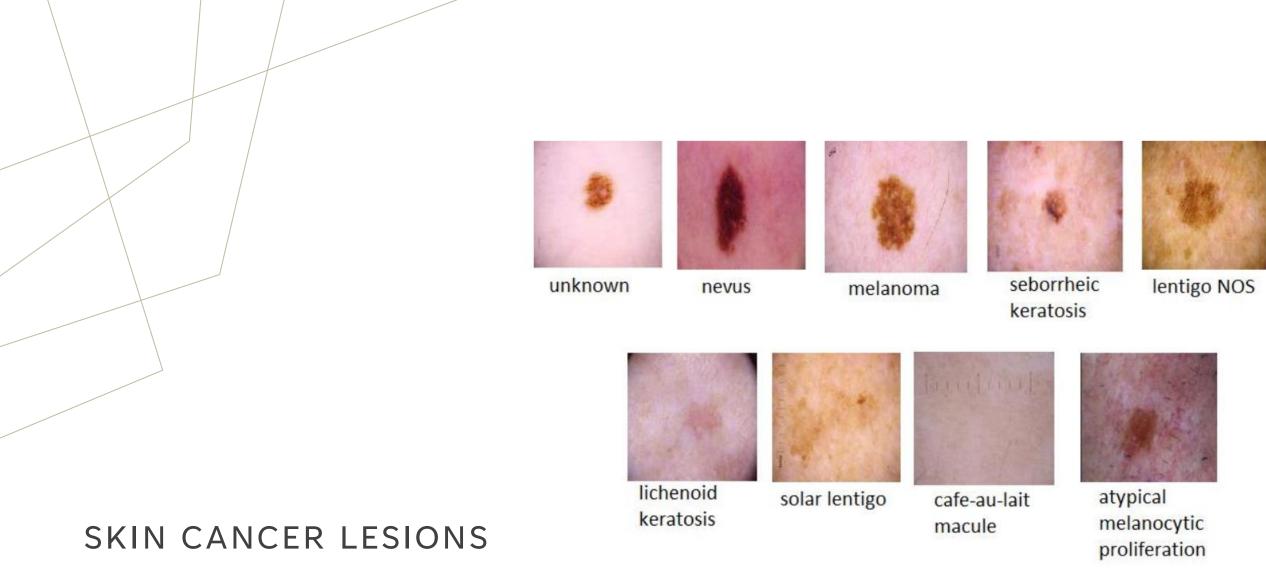
Amitkumar M Maheshwari

Research Presentation

Master of Science in Machine Learning and Artificial Intelligence



# BACKGROUND

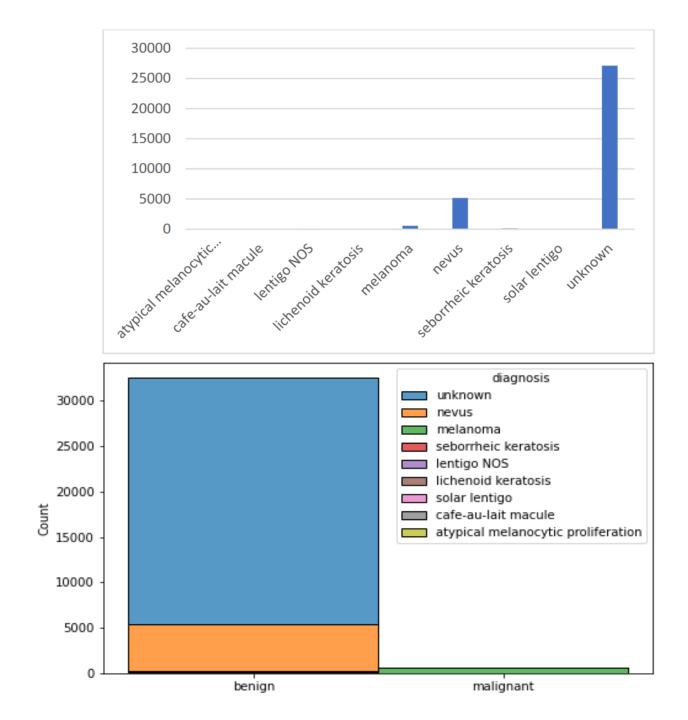


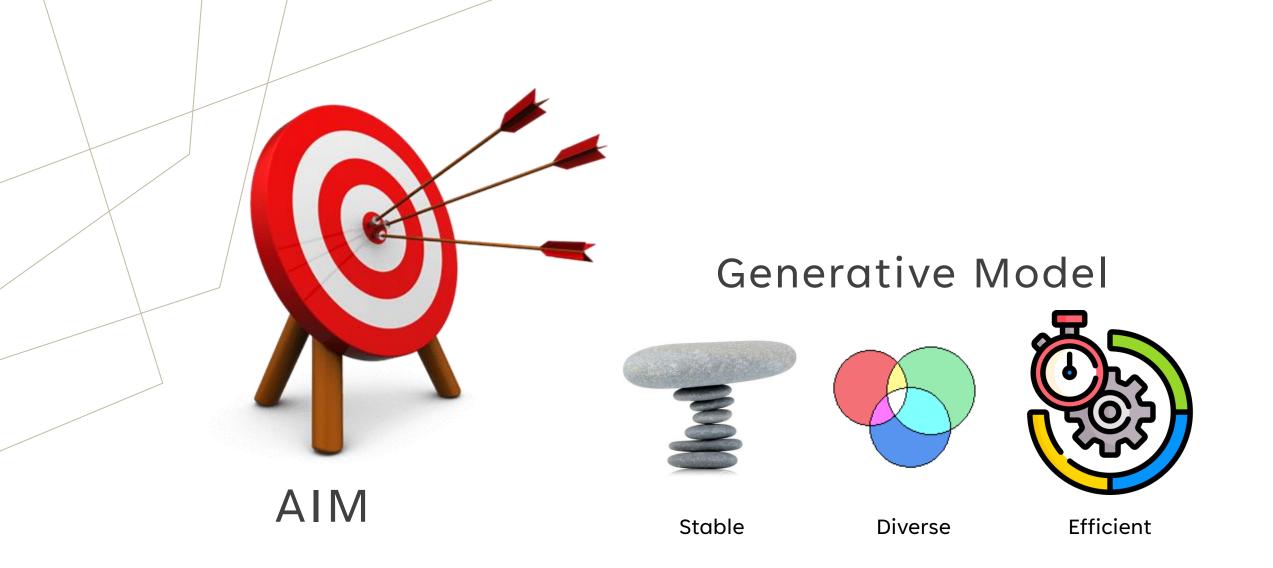
In ISIC 2020 Dataset

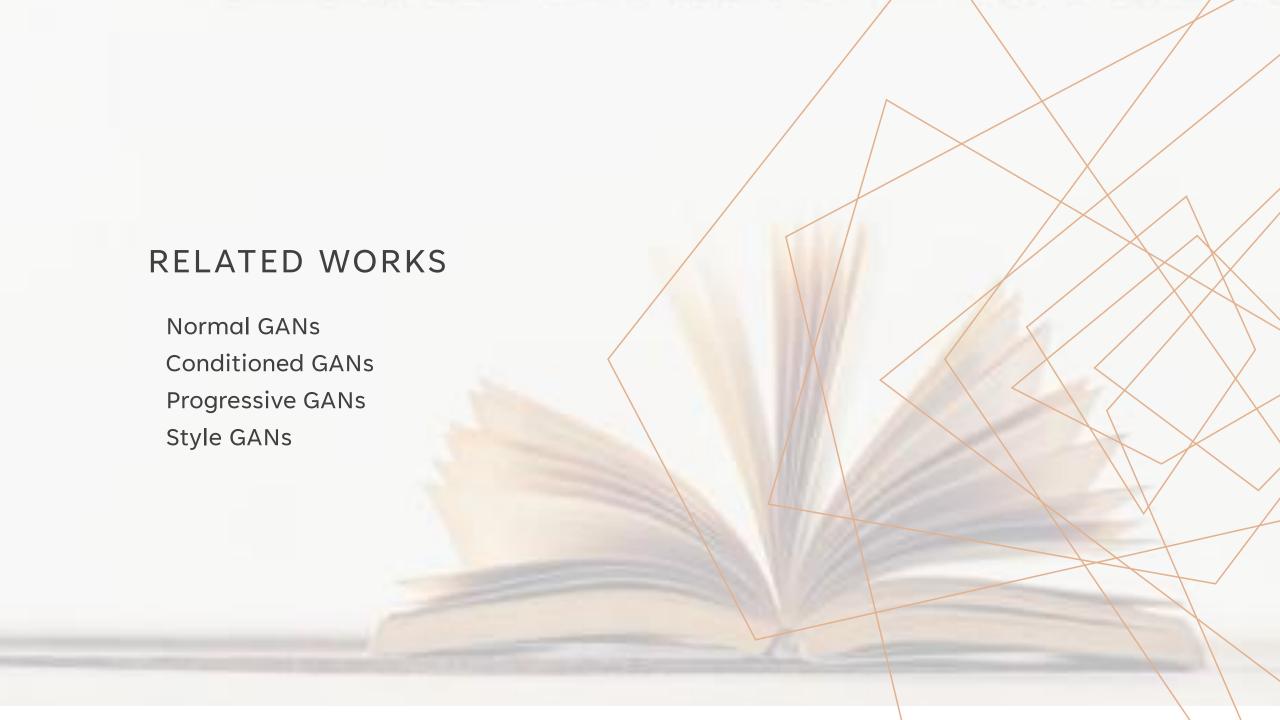


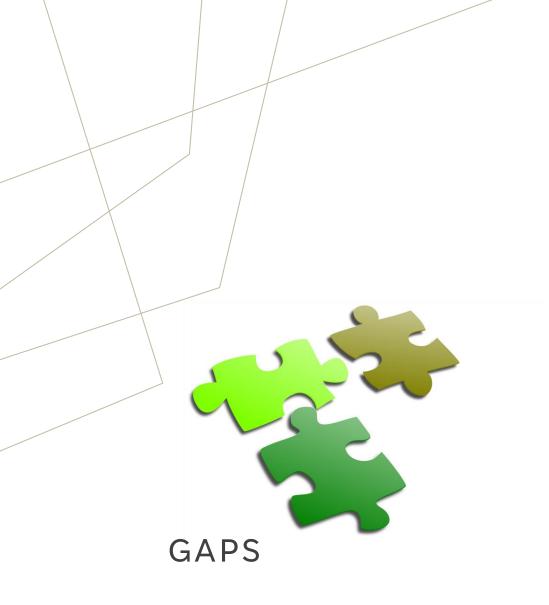
#### SKIN CANCER LESIONS

Class distribution





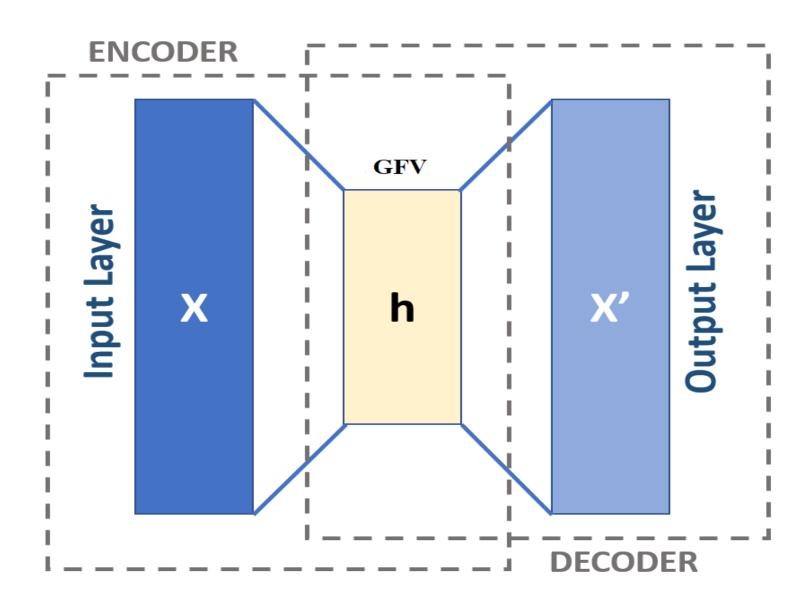




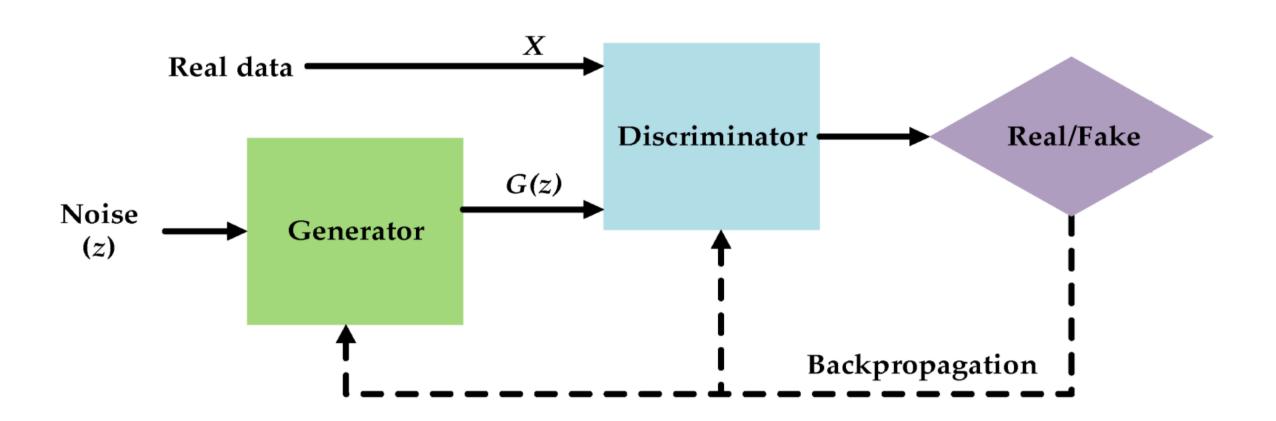
- Computationally Bulky and Time Consuming
- Often Unstable for higher resolution
- Generally Manual Evaluation is required
- Works better on Radiographic images
- Limited Exposer on Dermoscopic Images



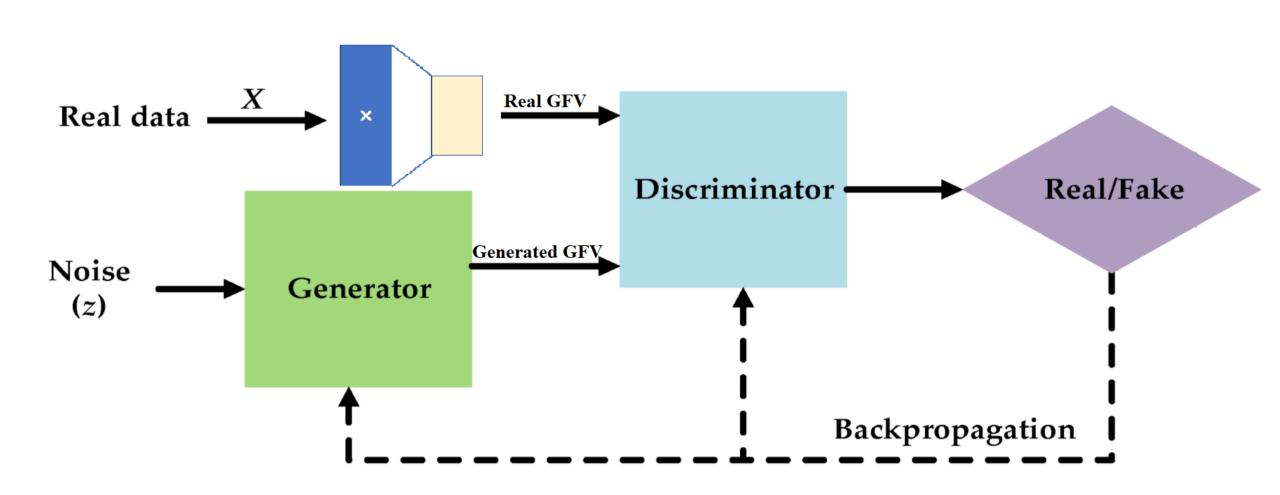
## **AUTOENCODER**

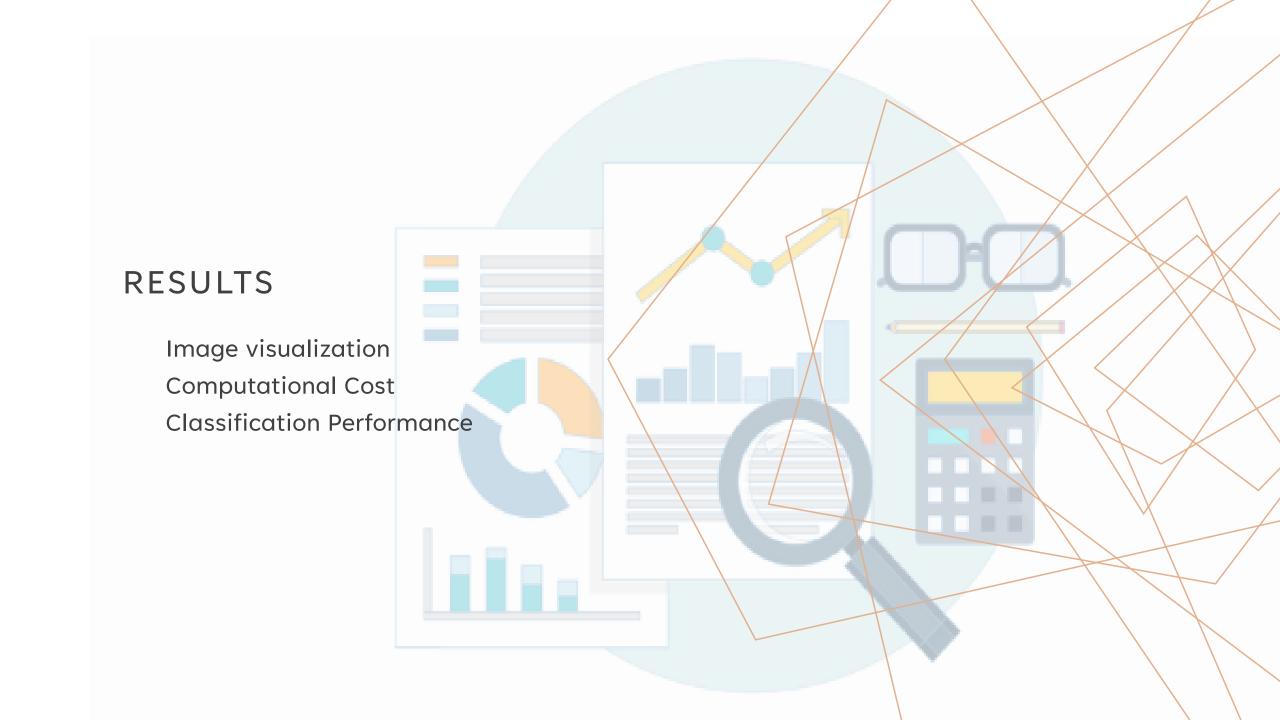


#### GENERATIVE ADVERSARIAL NETS

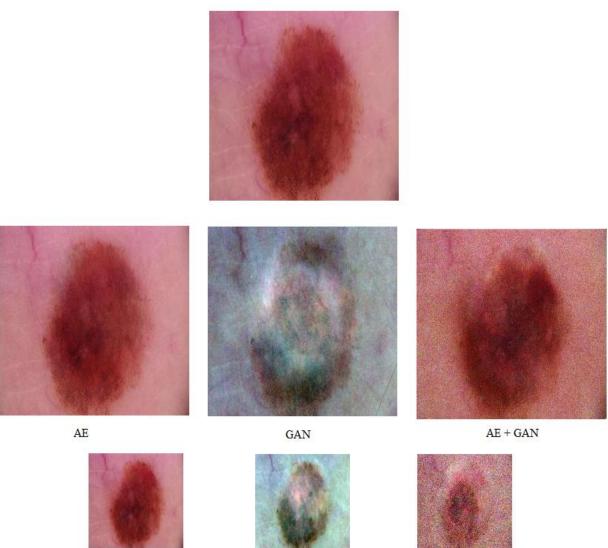


#### INTEGRATED SYSTEM OF AE AND GAN





# GENERATED IMAGES



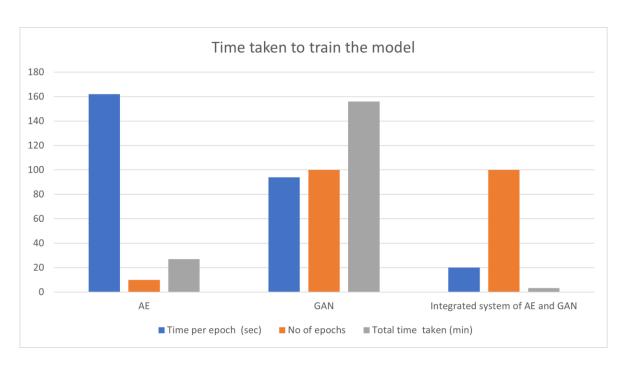
## INCEPTION SCORE

CASE	INCEPTION SCORE	
Two Identical Images	1.0	
AE Generated Image with Original Image	1.45	
GAN Generate Image with Original Image	2.16	
AE+GAN Generated Image with Original Image	1.89	
Two Totally Different Images	2.60	

## TRAINABLE PARAMETERS

MODEL	TRAINABLE PARAMETERS	
Autoencoder(AE)	855,994,368	
Generative Adversarial Nets(GAN)	607,285,633	
GAN with AE	15,683,546	

## TRAINING TIME



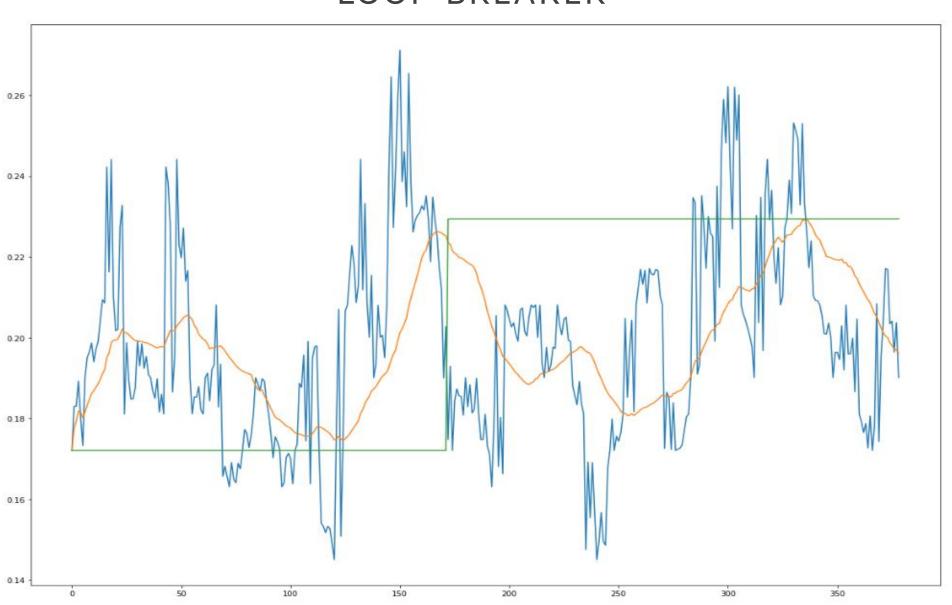
MODEL	TRAINING TIME (MINUTES)	
Autoencoder(AE)	27	
Generative Adversarial Nets(GAN)	156	
GAN with AE	3.33	

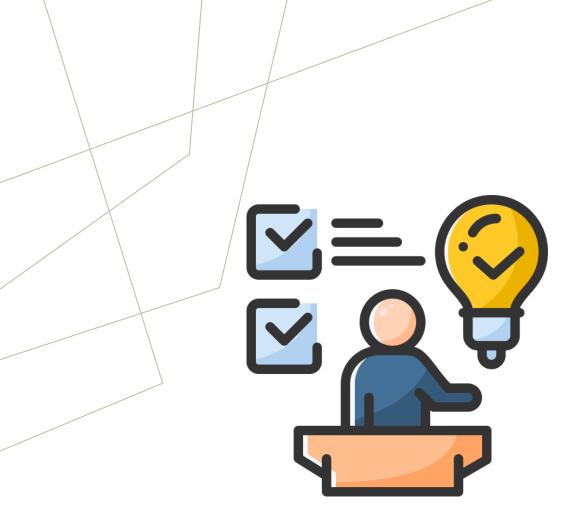
## CLASSIFICATION RESULTS

MODEL TRAINED USING	ACCURACY	SENSITIVITY
Untreated Dataset	Train: 0.94 Val: 0.88	0.084
Down sampling the dominant classes	Train: 0.87 Val: 0.75	0.33
Traditionally Transferred Images Augmented Dataset	Train: 0.86 Val: 0.77	0.48
GAN+AE Generated Images Augmented Dataset	Train: 0.91 Val: 0.82	0.57
Traditionally transferred with AE+GAN Generated Images Augmented Dataset	Train: 0.89 Val: 0.80	0.54

# LOOP BREAKER Epochs over End Batch wise No Batches over Is to break training loop Image Generation Pick the best Average last n result generator Discrimination End Store the details Evaluate the generator

# LOOP BREAKER





# **CONCLUSION**

#### Sensitivity Improved by 72%

Balancing the dataset with AE+GAN generated images improves the sensitivity from 0.33 to 0.57

#### Time Consumption decreased by 78.8%

The integrated system of AE and GAN takes around 33 minutes to get trained in comparison with 156 minutes taken by conventional GAN

#### FUTURE RECOMMENDATIONS

Image Segmentation
With
Image to Image translation

Conditional GAN
To
Augment other classes

Reinforcement Learning
To
Enhance efficiency
and performance of GAN



THANK YOU