



GENERATIVE ADVERSARIAL NETWORKS IN TMVA

PRESENTED BY

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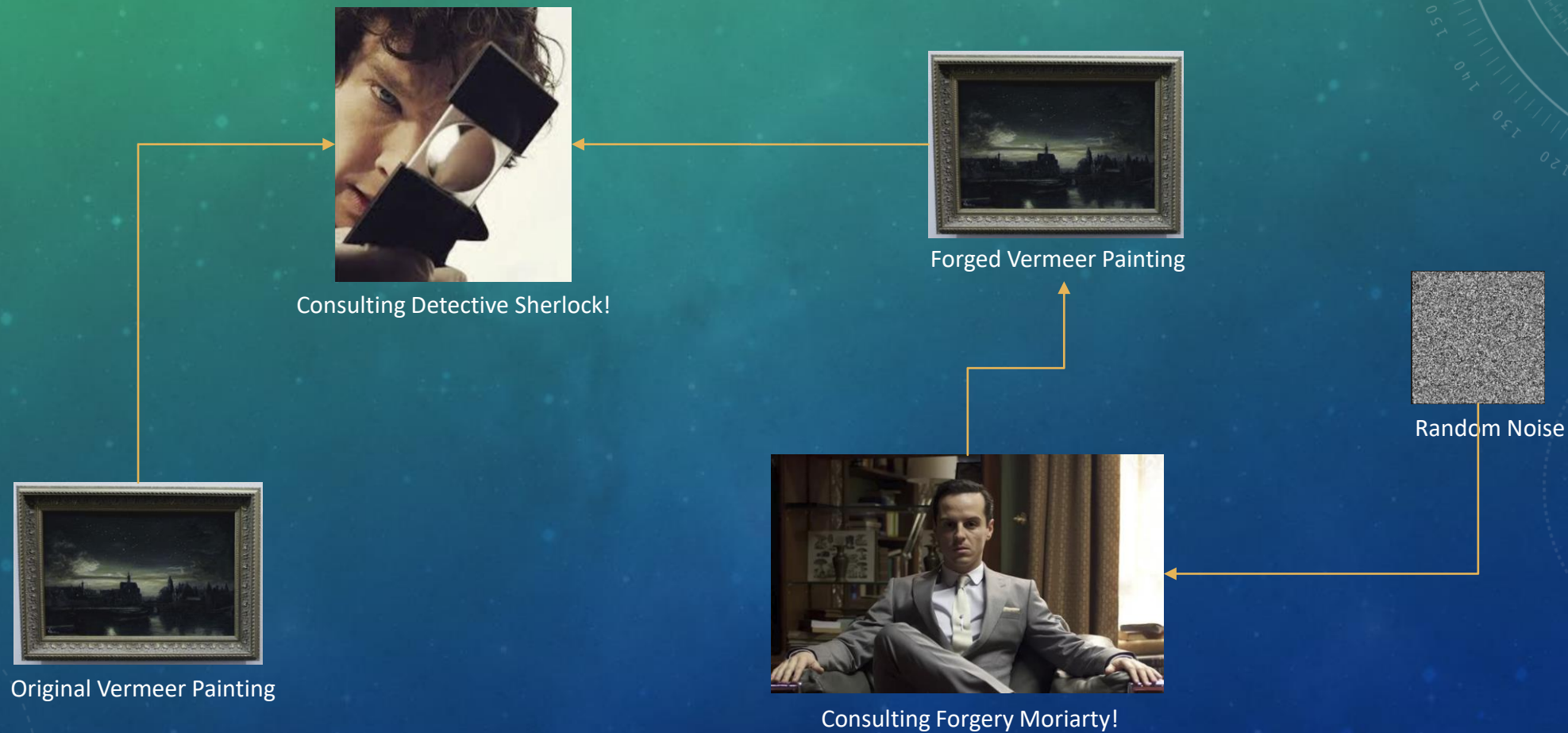
GENERATIVE VS. DISCRIMINATIVE MODELS

- Discriminative Models
 - ❖ Given data X , learn features to predict label Y . (Estimate $P(Y|X)$)
- Generative Models
 - ❖ Given training data X , learn representation of probability distribution for X .
 - ❖ Model $P(X)$ and sample from distribution to *generate* new data.

NEED FOR GENERATIVE MODELLING

- Can simulate possible futures using generative models.
- Can handle missing data effectively.
- Can be used for semi-supervised learning.
- Can handle multi-modal output based scenarios.

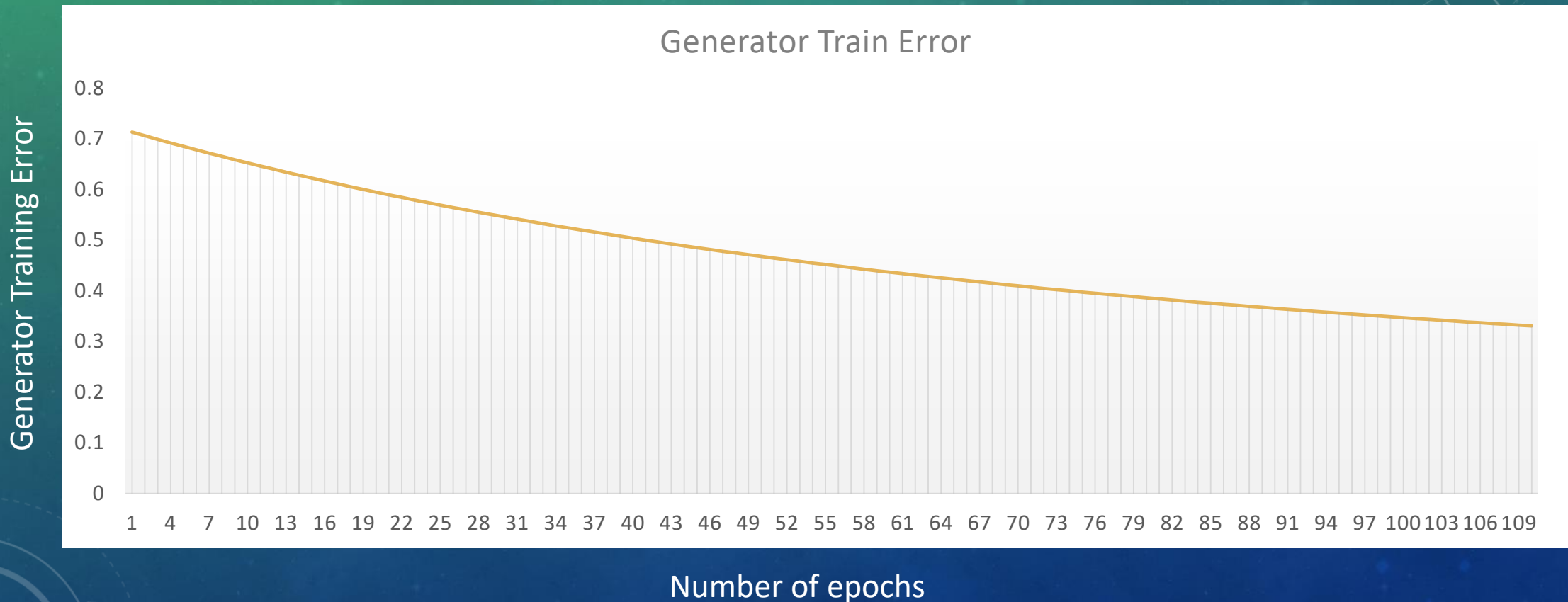
GENERATIVE ADVERSARIAL NETWORKS: AN EXAMPLE



CURRENT STATUS OF TMVA GAN MODULE

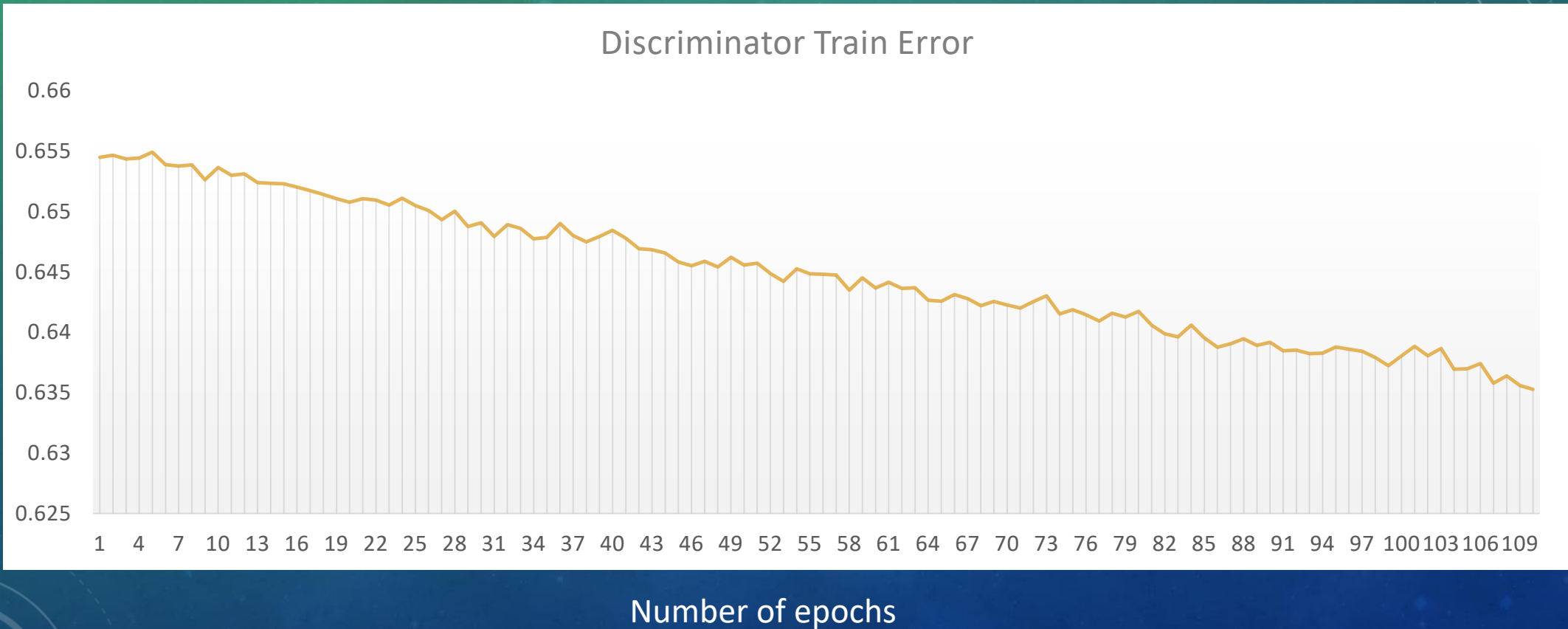
- Input, Batch and Network Layouts parsed for both generator and discriminator networks.
- Designed MethodGAN module to fit the TMVA framework.
- GAN framework developed entirely for TMVA.
- MethodGAN tested and running on MNIST data.
- Unit Tests developed and passing for MethodGAN.
- Integration tests developed and working for MethodGAN.
- Tutorial named TMVAGeneration created for testing and understanding the workings of Generative Adversarial Networks in TMVA.

LOSS RESULTS SEEN BY TRAINING USING METHODGAN (GENERATOR TRAINING ERROR)



LOSS RESULTS SEEN BY TRAINING USING METHODGAN (DISCRIMINATOR TRAINING ERROR)

Discriminator Training Error



FUTURE WORK

- Benchmarking MethodGAN against other standard implementations of Generative Adversarial Networks.
- Merge MethodGAN with root/master.
- Design a framework for Unsupervised Learning by creating an Unsupervised DataLoader and enabling unsupervised form of data in Factory Method.
- Use GANs for HEP problems (CaloGAN for generating EM calorimeter showers, for example)

QUICK LINKS

- Project Repository: <https://github.com/anushree110/root.git>
- Final Blog and Documentation: <https://medium.com/@anushreerankawat110/gsoc-2018-generative-adversarial-networks-in-tmva-554cda974584>

THANK YOU!