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Evaluation of Generative Adversarial Networks for Data Augmentation in Melanoma Identification

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1. Background-Aim

Melanoma:

- Skin cancer
- Increased mortality rates (up to 73%)
- Limited Dermoscopic image: Difficulty in training AI models

ISIC Archive:

Melanoma Dataset: 7,349 images

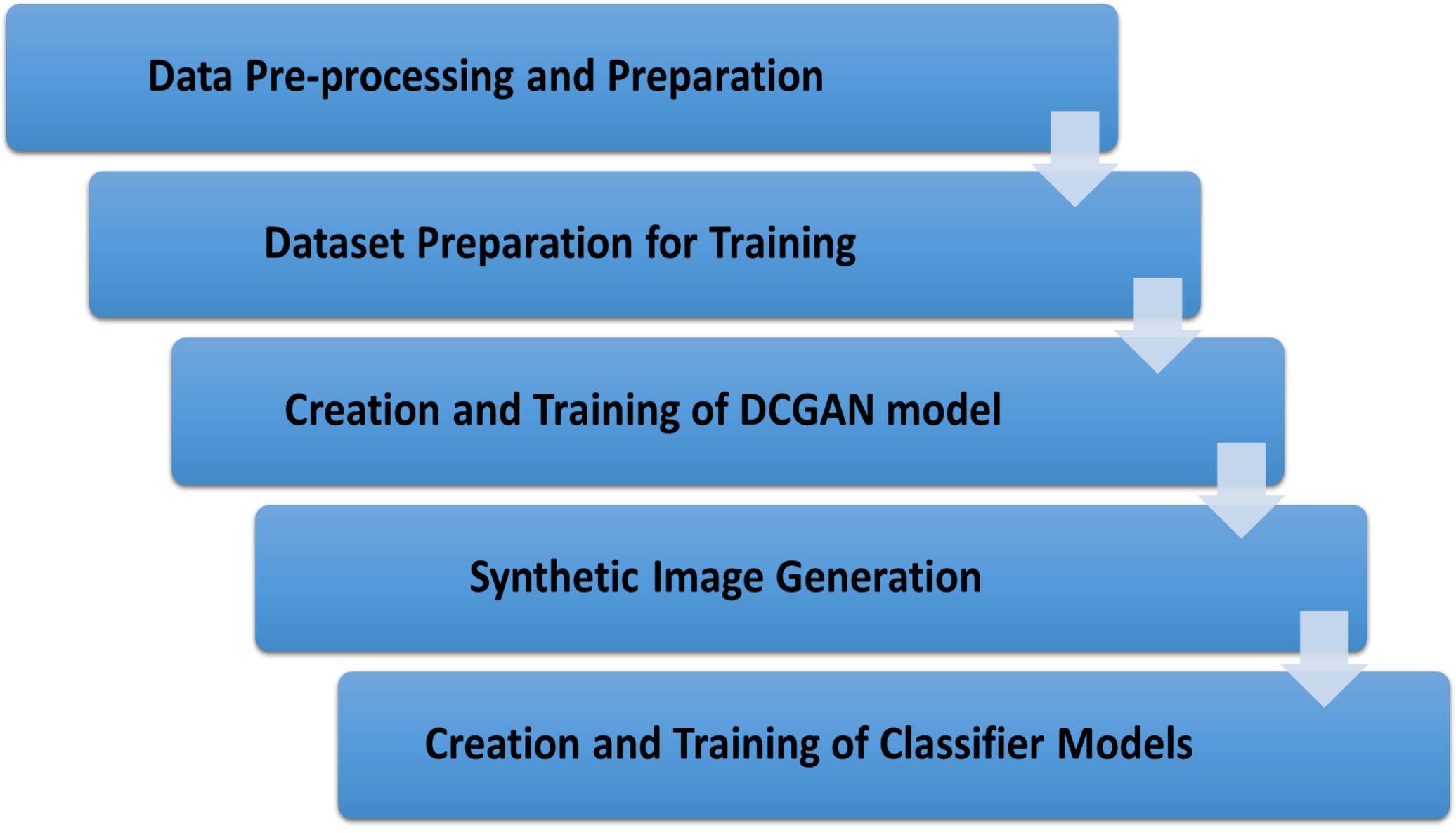
Nevus Dataset: 32,697 images

Class Imbalance

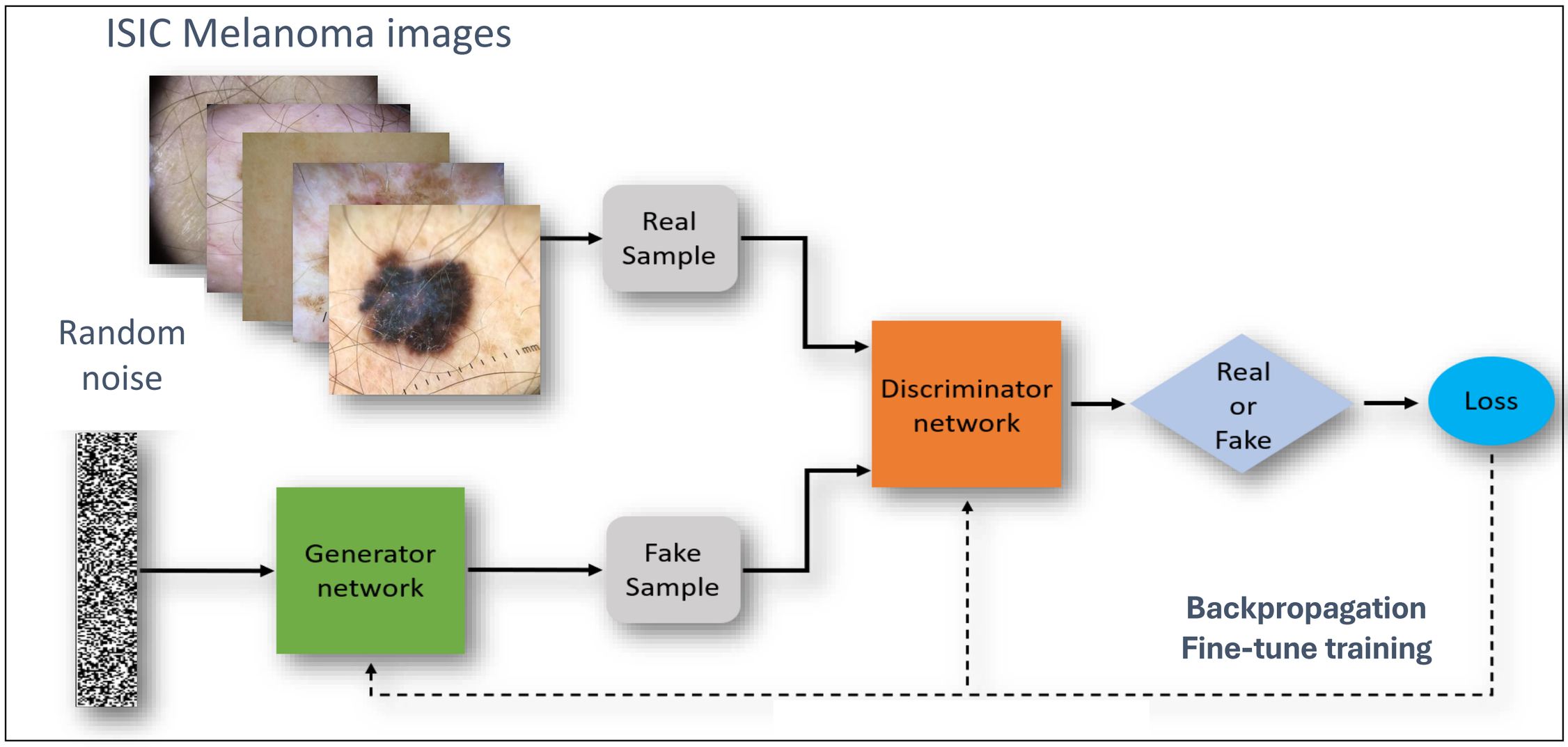
Purpose of thesis:

Melanoma Augmentation by implementing a Deep Convolutional Generative Adversarial Network (DCGAN)

2. Materials & Methods



Training of a Deep Convolutional GAN (DCGAN)



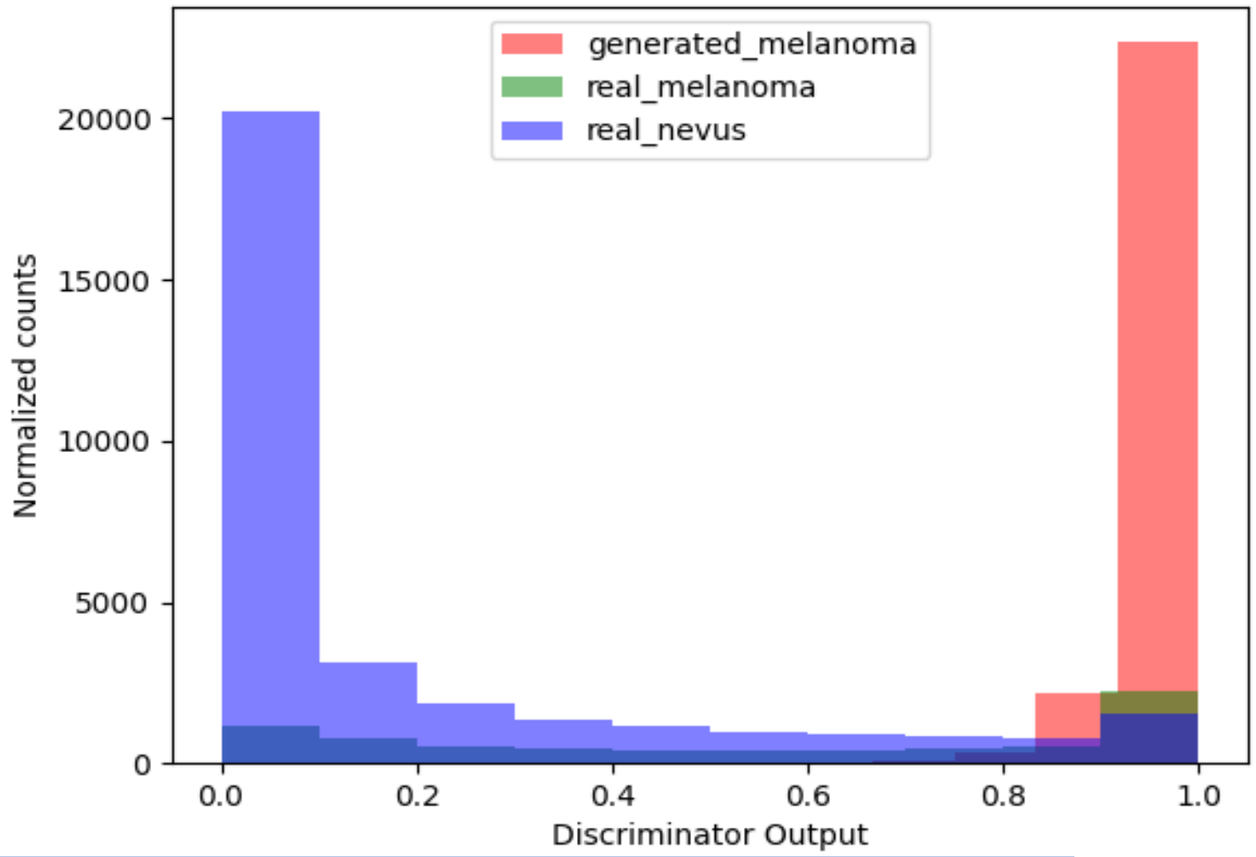
2. Materials & Methods

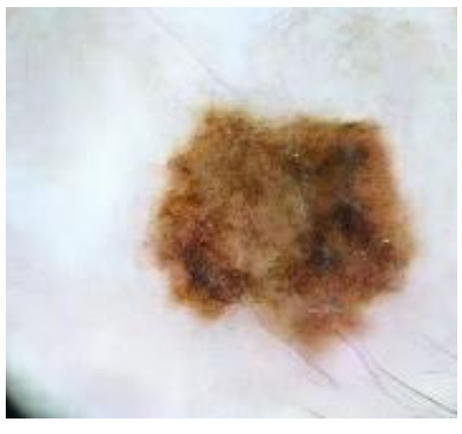
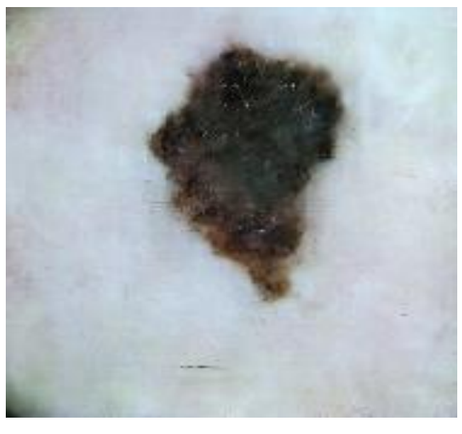
Generator synthesizes melanoma

+

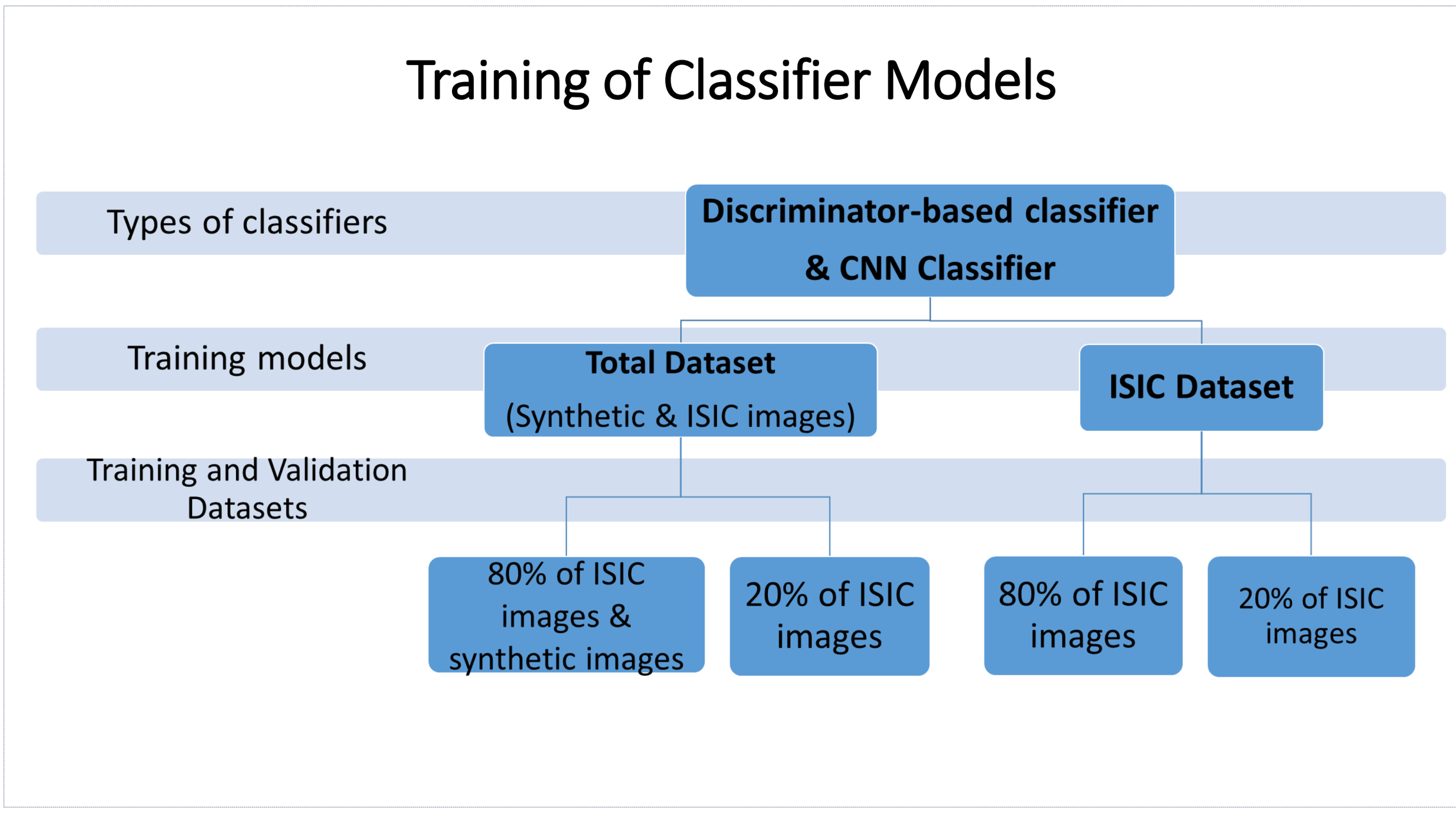
Discriminator threshold 0.95

→ 25,000 synthetic images



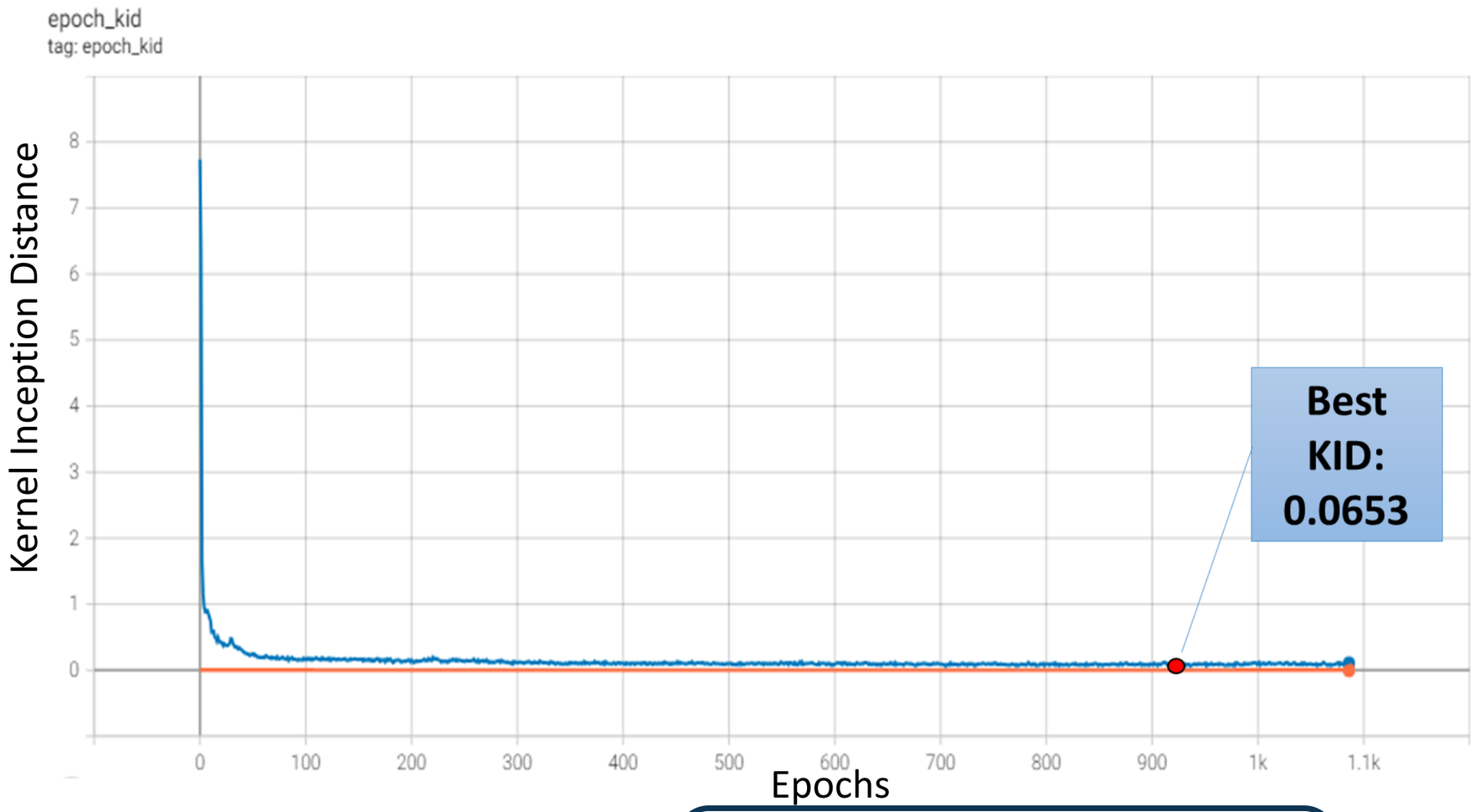





Synthetic images


Training of Classifier Models
Types of classifiers
Discriminator-based classifier & CNN Classifier
Training models
Total Dataset (Synthetic & ISIC images)
ISIC Dataset
Training and Validation Datasets
80% of ISIC images & synthetic images
20% of ISIC images
80% of ISIC images
20% of ISIC images

3. Results

Evaluation of Synthetic Melanoma Images Using KID Metric



- **KID:** Quantitative measure of how similar the generated images are to real images

- **KID = 0.0653**

Indicates high similarity between generated melanoma images and real images

⇩ KID => ⇧ Quality

3. Results

Evaluation of the Classifiers' Performance

	Discriminator-Based Classifier			CNN Classifier		
	AUC	Binary ACC	Recall	AUC	Binary ACC	Recall
All data	91,03%	86,89%	**69,16%**	91,10%	87,27%	**53,66%**
ISIC	90,63%	87,37%	**55,30%**	88,68%	85,67%	**49,32%**

Performance of Discriminator-based Classifier

- High **AUC & ACC** in both datasets: Strong ability of classifier to differentiate the classes
- Higher **Recall** when it trains with the dataset that contains the **synthetic images**

Performance of CNN Classifier

- High **AUC & ACC** in both dataset: Effective model in distinguishing between melanoma and nevus
- Significant drop in **Recall** in both datasets: Model is less sensitive in detecting true positive melanoma cases compared to the discriminator-based classifier

4. Conclusions

Effectiveness of DCGANs

- Realistic Image Generation from DCGAN model
- Addressing Data Scarcity

Enhanced Classifier Performance

- Synthetic images improve training and performance of classification models
- Higher Recall: Pre-trained Discriminator of the DCGAN model used as classifier

5. References

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