IIAI30018

Generative AI

AutoEncoder & VAE

Instructor: YuanFu Yang

yfyangd@nycu.edu.tw

AutoEncoder & VAE

- Homework due: 10/16
- Late submissions will incur a penalty of one point for each day overdue.
- The assignment allows a maximum extension of 3 days (it will not be accepted if submitted later than 3 days).
- Submit files: code and report (6 questions), and submit them in both **.ipynb** and **PDF** file formats respectively.
- This assignment can be carried out using Colab or completed on your PC.

AutoEncoder & VAE

Assignment:

- Application of Autoencoder and VAE on the "British Shorthair" Category from the Oxford-IIIT Pets Dataset

Objective:

- Use the “British Shorthair” category or others from the Oxford-IIIT Pets dataset to build and train Autoencoder and VAE model.
- After training, output and reconstruct 10 images of "British Shorthair" cats or others.

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Assignment Steps:

1. Data Processing:
- Download the Oxford-IIIT Pets dataset.
- Select only the images that contain the "British Shorthair" cat category or others.

2. Model Design:
- Design and implement two models: a simple **Autoencoder** and a **VAE**, each consisting of an Encoder and a Decoder module.

3. Model Training:
- Train both models using the **MSELoss** loss function to measure the difference between the reconstructed and the original images.

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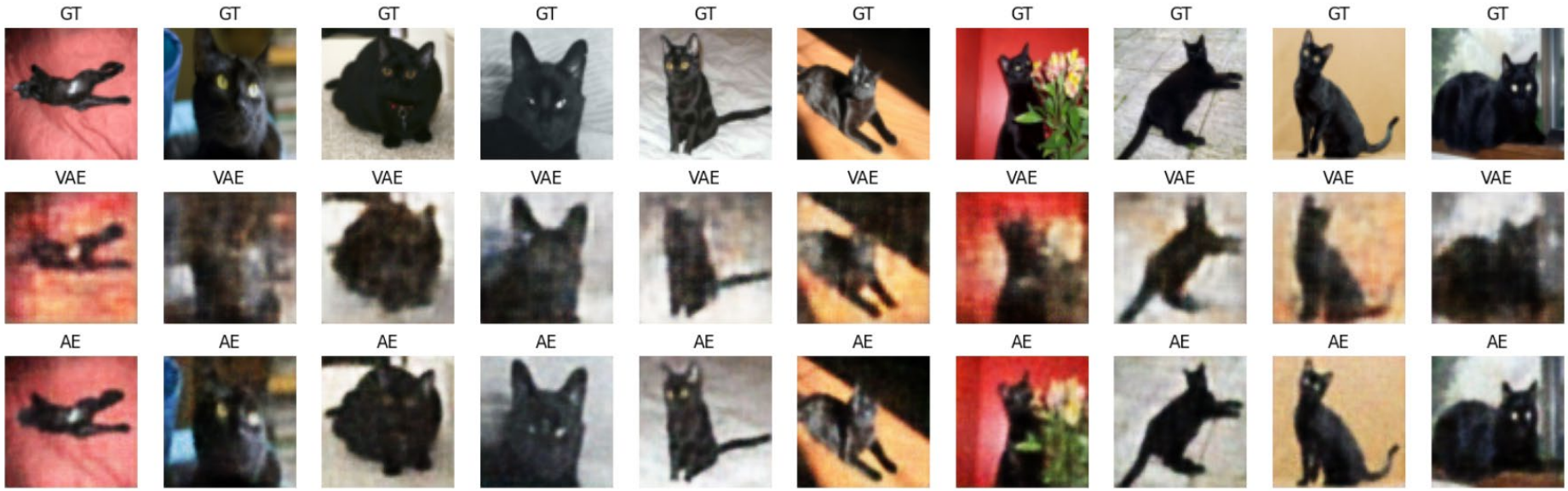
Assignment Steps:

4. Evaluation and Analysis:

Quantitative Analysis: Compare the Ground Truth (GT), Autoencoder (AE), and VAE reconstructions for a random sample of 10 images.



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Assignment Steps:

4. Evaluation and Analysis:

Qualitative Analysis: Evaluate the models using PSNR (Peak Signal-to-Noise Ratio), SSIM (Structural Similarity Index Measure), and LPIPS (Learned Perceptual Image Patch Similarity) to assess reconstruction quality.

	Metric	AE	VAE
0	PSNR	27.436608	18.761317
1	SSIM	0.821837	0.521974
2	LPIPS	0.101562	0.304445

Greedy Best-First Search

- Homework Question:

  Q1: Describe your Autoencoder model, including details about the Encoder and Decoder architecture, the activation functions used, any regularization techniques applied, and other relevant components.

  Q2: Explain how you trained the model, specifying the loss function, optimization method, learning rate, and any other training-related details.

  Q3: Qualitative Analysis: Display the inference results for a random sample of 10 images, showing the Ground Truth, the predictions from the AE, and the predictions from the VAE.

  Q4: Introduce the qualitative evaluation metrics: PSNR (Peak Signal-to-Noise Ratio), SSIM (Structural Similarity Index Measure), and LPIPS (Learned Perceptual Image Patch Similarity).

  Q5: Present the qualitative analysis results for both the AE and VAE models, including the PSNR, SSIM, and LPIPS values.

  Q6: Conclusion: Based on the training and testing results of the AE and VAE models, provide a summary and final conclusion for this assignment.

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HW1: AE & VAE

Q & A

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