

# Least Square Adversarial Autoencoder dan Aplikasinya untuk Rekonstruksi dan Pembangkitan Citra = Least Square Adversarial Autoencoder and Its Application for Image Reconstruction and Image Generation

Sinaga, Marshal Arijona, author

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## Abstrak

Tugas Akhir ini menelaah least square adversarial autoencoder yang menggunakan least square generative adversarial network sebagai diskriminatornya. Diskriminator tersebut meminimalkan fungsi Pearson 2 divergence antara distribusi variabel laten dan suatu distribusi apriori. Adanya diskriminator memungkinkan autoencoder untuk membangkitkan data yang memiliki karakteristik yang menyerupai sampel pembelajarannya. Penelitian ini dilakukan dengan membuat program yang memodelkan least square adversarial autoencoder. Program memodelkan dua jenis autoencoder yaitu unsupervised least square adversarial autoencoder dan supervised least square adversarial autoencoder dengan memanfaatkan dataset MNIST dan FashionMNIST. Unsupervised least square adversarial autoencoder menggunakan variabel laten berdimensi 20 sementara supervised least square adversarial autoencoder menggunakan variabel laten masing-masing berdimensi 2, 3, 4, dan 5. Program diimplementasikan menggunakan framework PyTorch dan dieksekusi menggunakan Jupyter Notebook. Seluruh aktivitas pemrograman dilakukan pada environment cloud yang disediakan oleh Floydhub dan Tokopedia-UI AI Center yang masing-masing menggunakan GPU NVIDIA Tesla K80 dan NVIDIA Tesla V100 sebagai perangkat komputasinya. Proses pembelajaran pada unsupervised least square adversarial autoencoder berlangsung selama dua jam sementara pada supervised least square adversarial autoencoder berlangsung selama enam jam. Berdasarkan hasil eksperimen, nilai mean squared error unsupervised least square adversarial autoencoder untuk masing-masing dataset MNIST dan FashionMNIST adalah 0.0063 dan 0.0094. Sementara itu, nilai mean squared error supervised least square adversarial autoencoder pada dataset MNIST sebesar 0.0033. Selanjutnya, nilai Frechet Inception Distance unsupervised least square adversarial autoencoder untuk masing-masing dataset MNIST dan FashionMNIST adalah 15.7182 dan 38.6967. Sementara itu, nilai Frechet Inception Distance supervised least square adversarial autoencoder pada dataset MNIST sebesar 62.512. Hasil tersebut menunjukkan bahwa least square adversarial autoencoder mampu merekonstruksi citra dengan baik, namun kurang mampu membangkitkan citra dengan kualitas sebaik sampel pembelajarannya.

.....This Final Project (Tugas Akhir) investigates the least square adversarial autoencoder that uses least square generative adversarial network as its discriminator. The discriminator minimizes the Pearson 2 divergence between the latent variable distribution and the prior distribution. The presence of discriminator allows the autoencoder to generate data that has characteristics that resemble the original data. Python programs were developed to model the least square adversarial autoencoder. This programs try to model two types of autoencoder namely unsupervised least square adversarial autoencoder and supervised least square adversarial autoencoder by utilizing MNIST dataset and FashionMNIST dataset. The unsupervised least square adversarial autoencoder uses latent variables of dimension 20 while the supervised least square adversarial autoencoder uses latent variables with dimensions of 2, 3, 4, and 5, respectively. This programs were implemented using PyTorch and executed using Jupyter Notebook. All of the programming activities

are carried out in the cloud environment provided by Floydhub and Tokopedia-UI AI Center, respectively using NVIDIA Tesla K80 GPU and NVIDIA Tesla V100 GPU as their computing resource. Training time in unsupervised least square adversarial autoencoder lasts for two hours while in supervised least square adversarial autoencoder lasts for six hours. The Results of experiments show that the mean squared error of unsupervised least square adversarial autoencoder for MNIST dataset and FashionMNIST dataset are 0.0063 and 0.0094, respectively. Meanwhile, the mean squared error of supervised least square adversarial autoencoder for MNIST dataset is 0.0033. Furthermore, the Frechet Inception Distance scores of unsupervised least square adversarial autoencoder for MNIST dataset and FashionMNIST dataset are 15.7182 and 38.6967, respectively. Meanwhile, the value of Frechet Inception Distance score of supervised least square adversarial autoencoder in MNIST dataset is 62.512. These results indicate that the least square adversarial autoencoder is able to reconstruct the image properly, but is less able to generate images with the same quality as the learning sample.