# Generative Models for Pokémon

You work at Game Freak, the developer of the Pokémon series. To cut costs, the company decides to use generative models to generate all the Pokémon design for the new games. You are given the task of training these models.

## A Pokémon GAN

- First, read this paper which solves some of the problems of GAN training by proposing best practices and useful tricks: https://arxiv.org/abs/1511.06434. In addition, you can also read the "Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow" book, 2nd edition, pages 698ff, which also discusses best practices for training GANs.
- Download a dataset of Pokémon images from here: https://www.kaggle.com/datasets/kvpratama/pokemon-images-dataset
- Resize them to 32x32 and convert them to greyscale (e.g., on the Linux Shell, you can use the `convert` command). If you have a lot of compute available, you can also try higher resolutions and/or color images.
- Train a GAN on these images. You can start with the base architecture that we used to generate MNIST images, which you can find on Stud.IP. Try to improve the sample quality by using the hints from the paper and book.
- If you do not have a GPU, I suggest running your code in Google Colab (even in the free version, you can use a GPU which is much faster than training on your CPU).

## Variational Autoencoder

Now train a VAE for the same task. Is there some meaningful/interesting structure in the latent space that you can observe? How does the quality of the generated images change when you change the dimensionality of the latent space or other hyperparameters?

## Comparing the models

To evaluate the visual quality of generated images, the *Fréchet Inception Distance* (FID) is often used. Read about the metric here: https://lightning.ai/docs/torchmetrics/stable/image/frechet_inception_distance.html. Compute the FID for at least one of your GANs and VAEs. If you want to spend some more time on this, you can do a hyperparameter evaluation, similar to the CNN exercise.

Upload the Jupyter notebook and some generated images to StudIP. To give you time to work on the assignment, there are no lectures on 23.06. (but there is a lecture on 26.06.). Deadline: **29.06.2024**