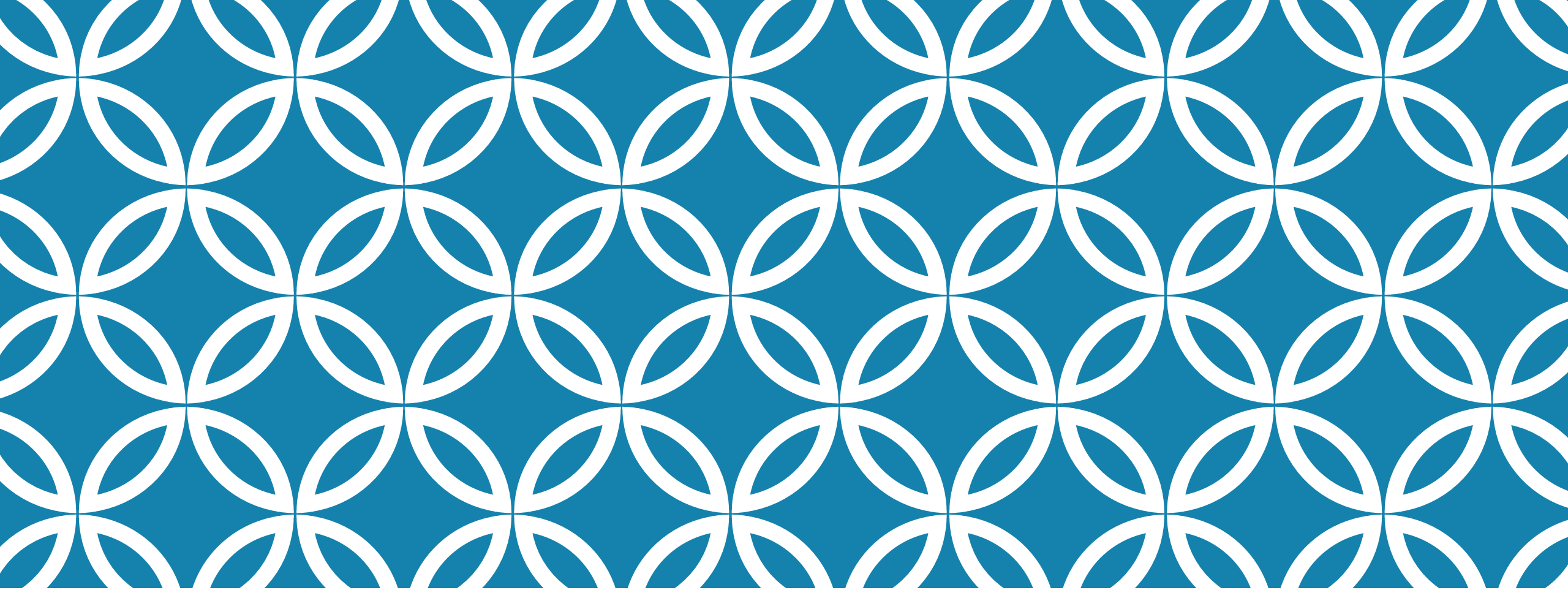


APPLICATIONS FOR GENERATIVE ADVERSARIAL NETWORKS IN GAME DEVELOPMENT

Petercă Adrian

26 Jan 2023

CONTENTS

CHALLENGES IN GAME DEVELOPMENT

Generating levels with diverse difficulties

Adapting new levels to a user's needs

Mimicking already created levels

Generating new, playable levels from random noise

The same goes for textures, backstories, quests, dialogue etc.

CURRENT STATE-OF-THE-ART APPROACHES

Evolutionary Search

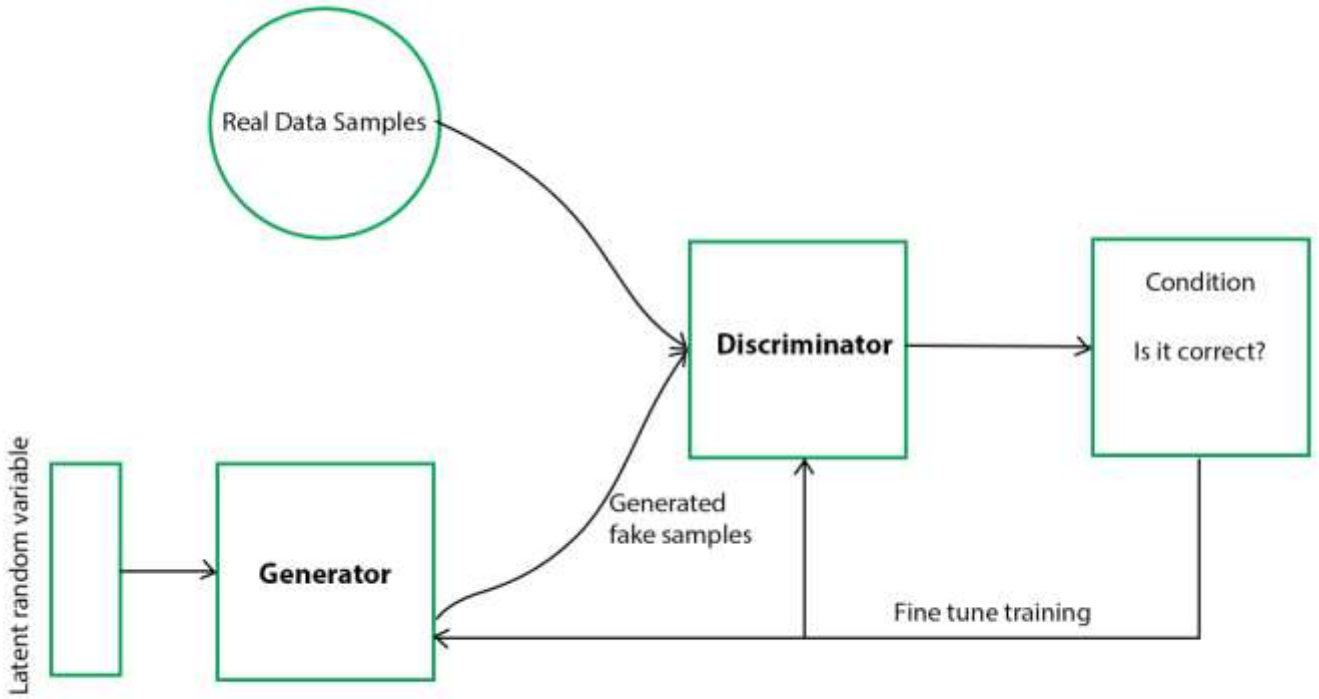
Reinforcement Learning

Deep Convoluted Neural Networks

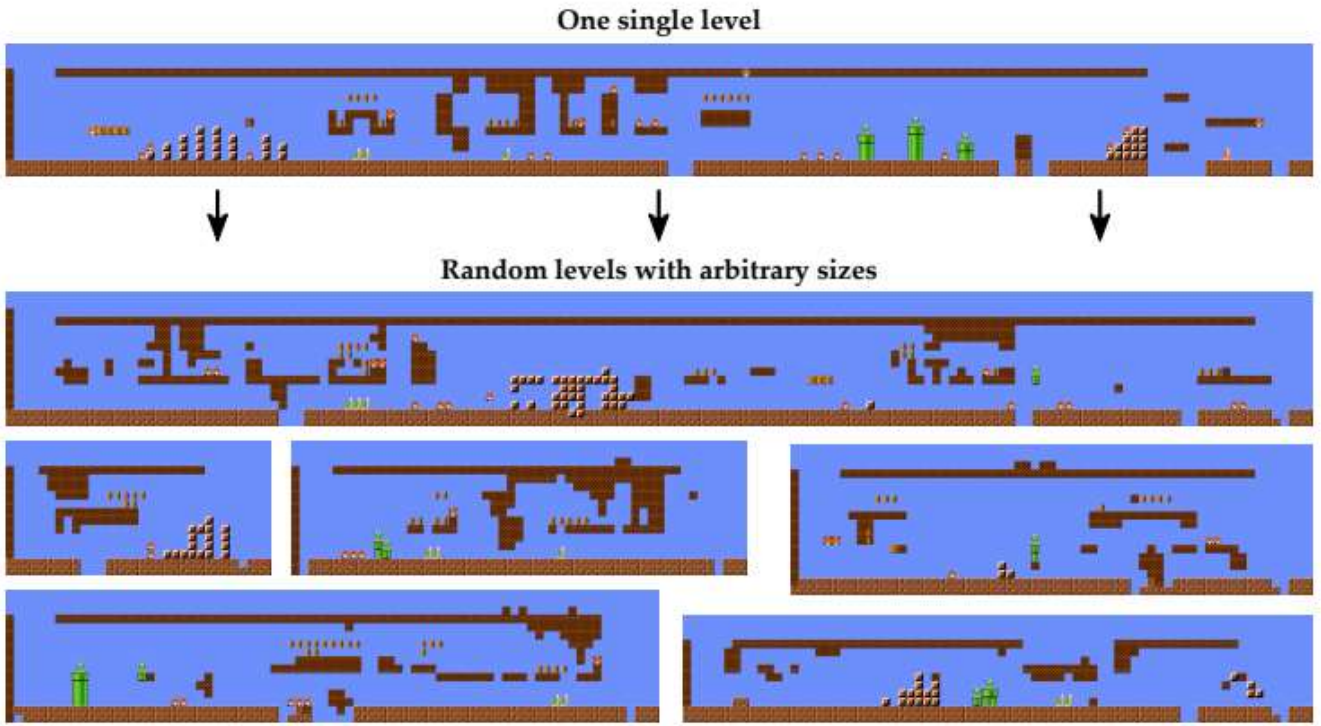
Generative Adversarial Networks

Stable Diffusion

GENERATIVE ADVERSARIAL NETWORKS

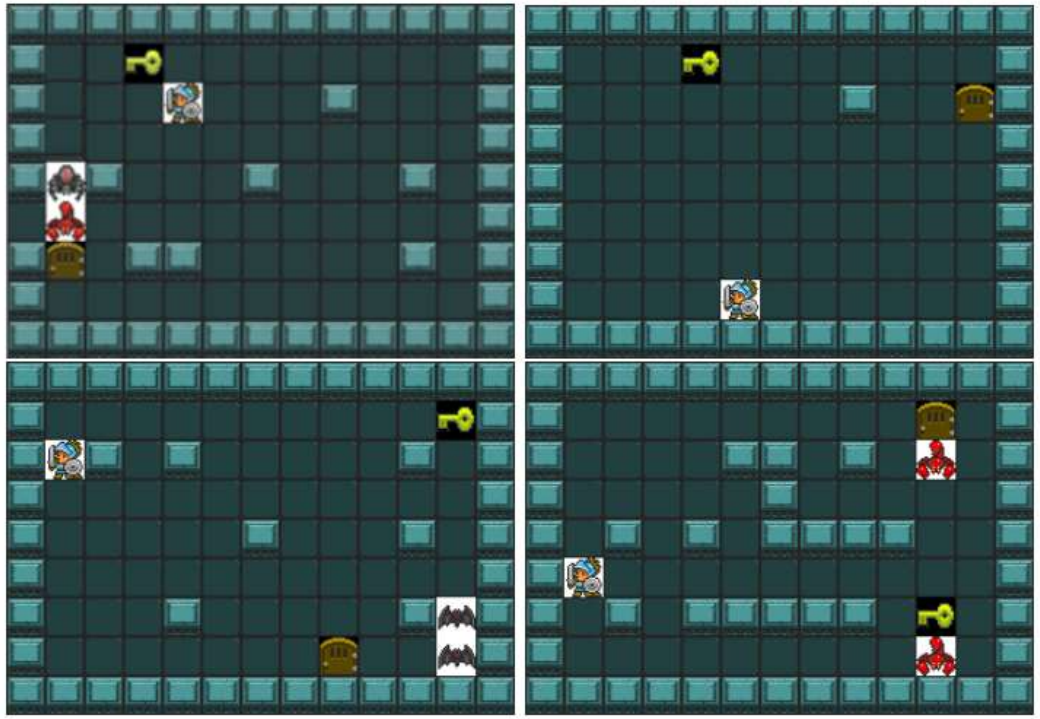


GENERATIVE ADVERSARIAL NETWORKS

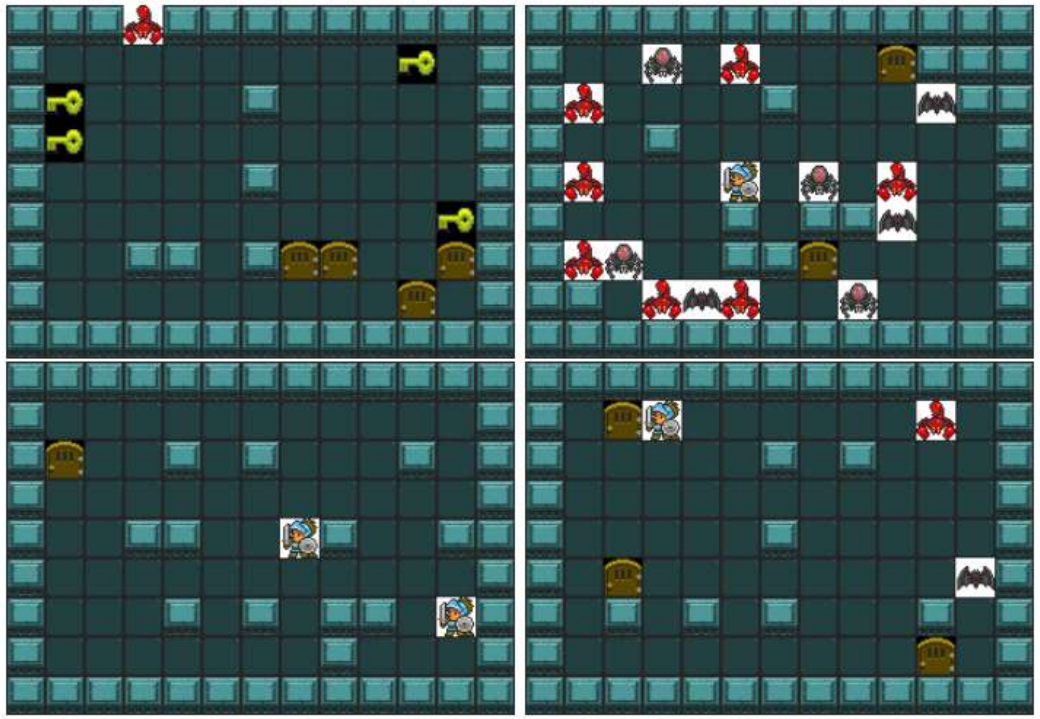


TOAD-GAN

GENERATIVE ADVERSARIAL NETWORKS



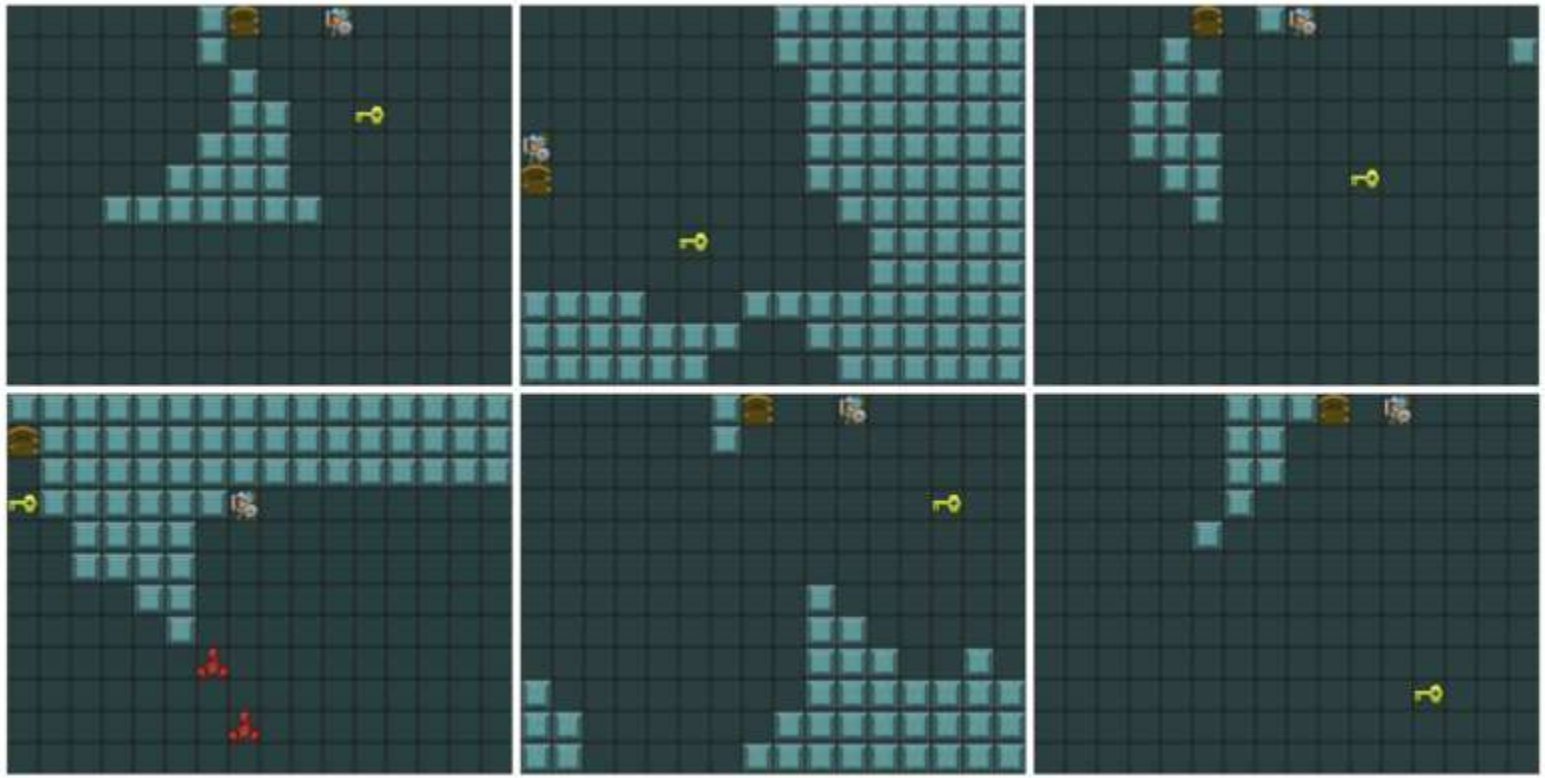
(a) Playable Levels



(b) Unplayable Levels

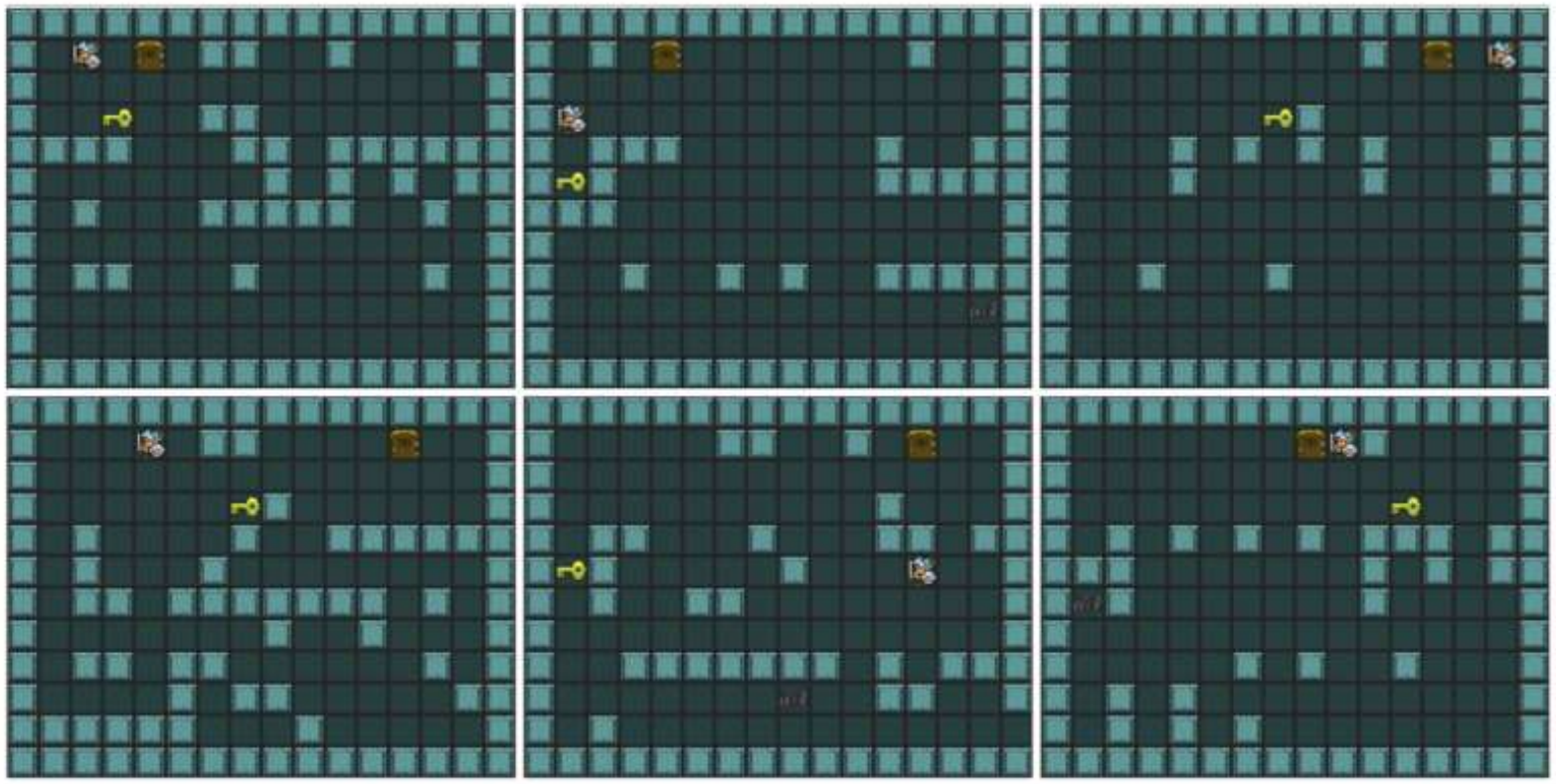
CESAGAN with bootstrapping

GENERATIVE ADVERSARIAL NETWORKS



Selection of Self-Supervised Generated GVGAI Levels Trained from Nothing

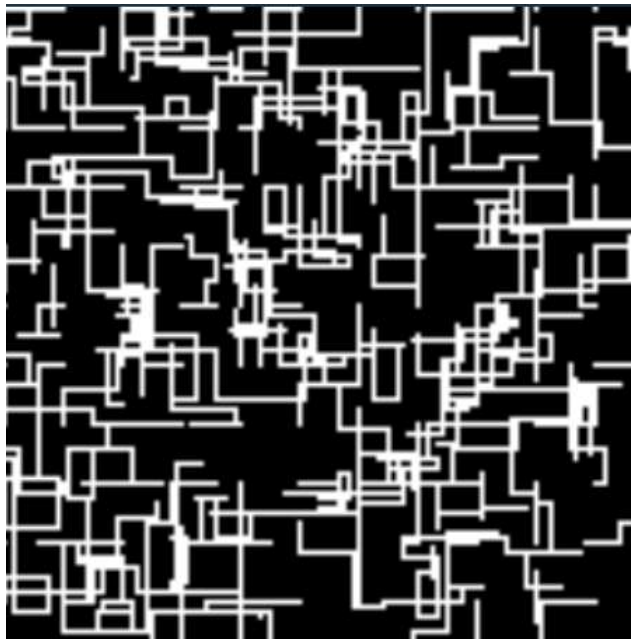
GENERATIVE ADVERSARIAL NETWORKS

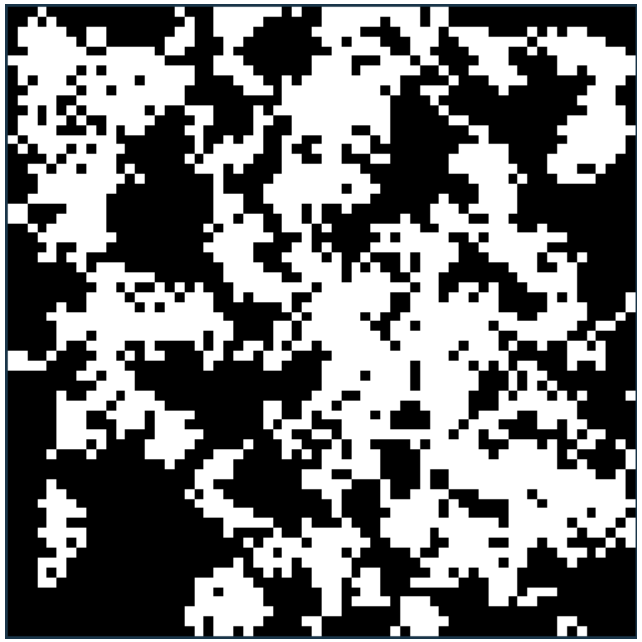


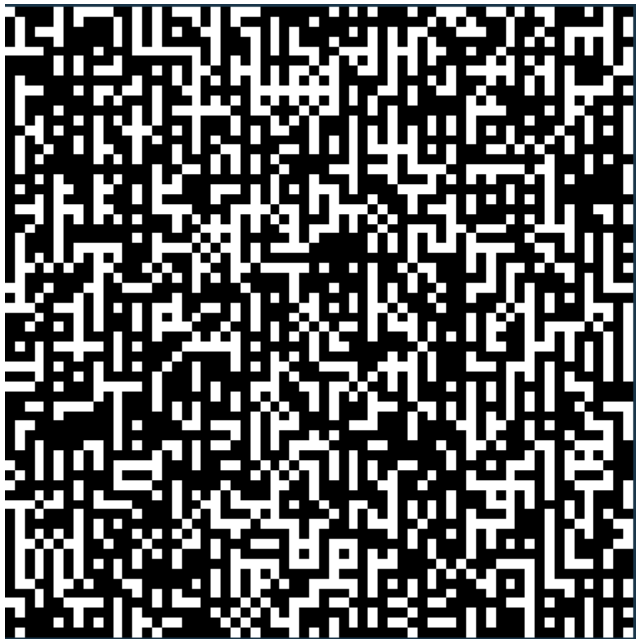
Selection of Semi-Supervised Generated GVGAI Levels Trained from 5 Examples

PERSONAL EXPERIMENTS

Level generation using random search in order to create simple levels on which to train further implementations (in the case of a 2D puzzle game)

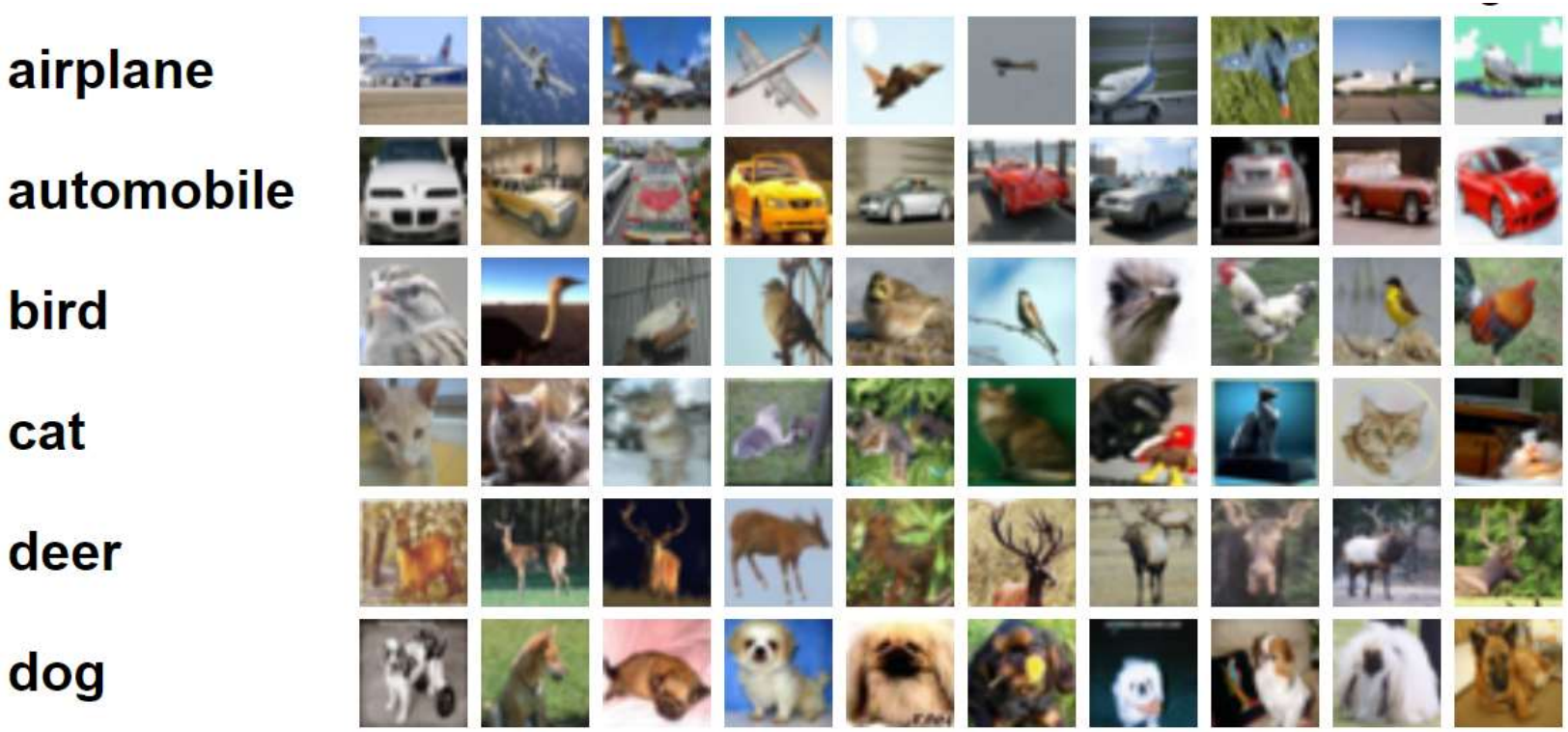






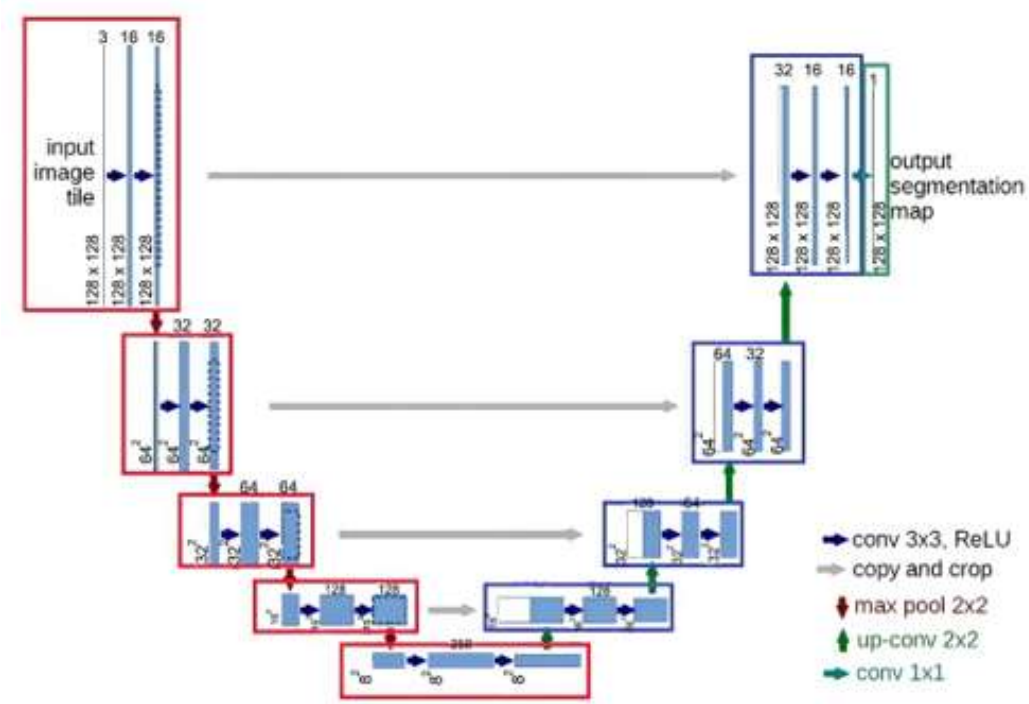
PERSONAL EXPERIMENTS

Training image classifiers to test their accuracy and overall time efficiency (for example with the CIFAR-10 dataset)



PERSONAL EXPERIMENTS

Testing state-of-the-art (U-Net, DALL-E, ChatGPT to name a few) in order to understand what they are capable of



PERSONAL EXPERIMENTS

Here is an example of TextSynth writing a backstory for a given character

Completed Text:

I am a sailor and this is my backstory.

It's been over two years since I last posted here on the blog. The reason is that my days as a liveaboard sailor are long gone. The last time I had a steady job with a steady salary was in 2011. It all came to an end last year when a freak storm rolled in and washed me out to sea. But enough of my sob story!

After that unfortunate incident I had several months off. I moved from a sailboat to a houseboat on the water. I was still living the dream. I did what I enjoyed most and enjoyed doing very little. After all the sailing was a part of my job but I had enough time left over to get some of those things done that I had long put off.

The houseboat was pretty nice. It's a small aluminum pontoon and about 20 feet long. But by the time I had sold the sailboat I could hardly even stand to be in the boat.

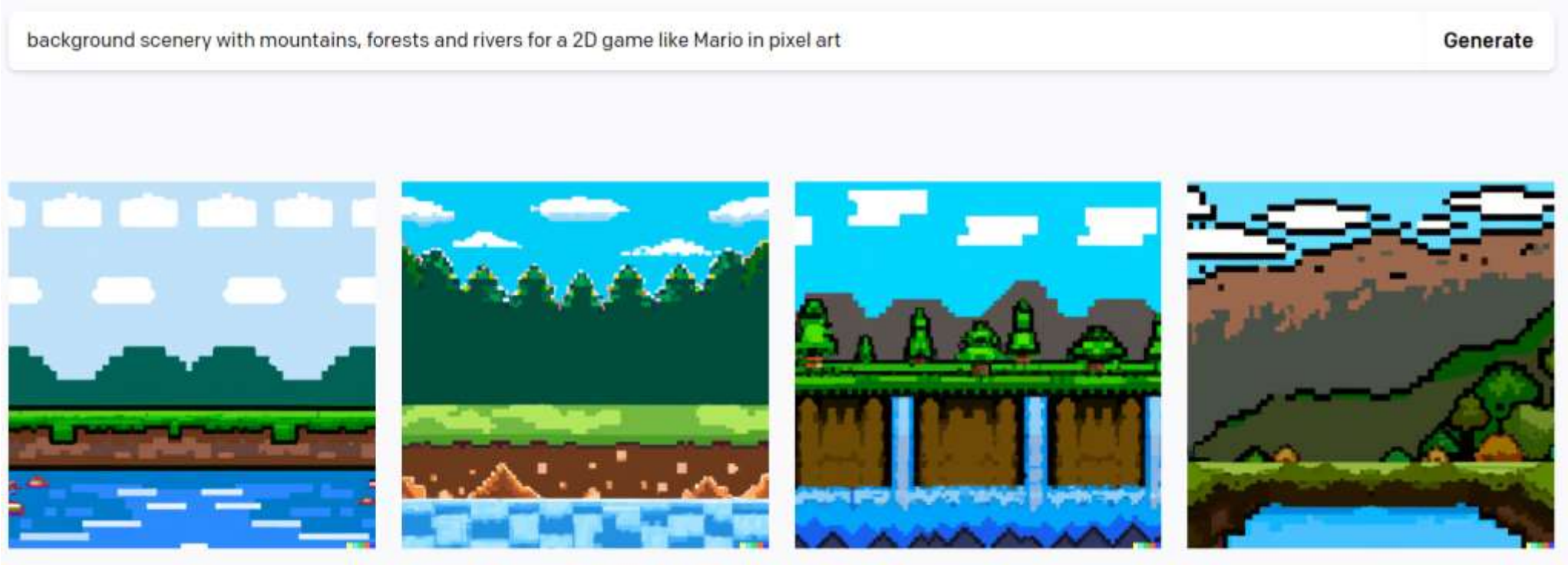
FUTURE WORK AND DIRECTIONS

Testing level generation for 2D games using various implementations of GANs, for example:

- simple GANs (fully connected layers and no convolutions)
- evolutionary GANs (in which the generator is evolved using a population)
- class conditioned GANs (similar to CycleGANs)
- patch GANs (they tend to perform better than others when the training data is limited)

FUTURE WORK AND DIRECTIONS

Investigating other methods for content generation (for example, text-to-image applications like DALL-E)



FUTURE WORK AND DIRECTIONS

Converting existing levels to different scenarios (for example, converting a desert level texture to a snowy hill texture)

BIBLIOGRAPHY

Learning to Generate Levels From Nothing

Level generation and style enhancement — deep learning for game development overview

Bootstrapping Conditional GANs for Video Game Level Generation

TOAD-GAN: Coherent Style Level Generation from a Single Example

Neuroevolution of Generative Adversarial Networks

Using Multiple Generative Adversarial Networks to Build Better-Connected Levels for Mega Man

Q & A