NORTHWEST NAZARENE UNIVERSITY

Cyber Forensics Murder Mystery: Fake Profiles

Thesis:
Submitted to the Department of Mathematics and Computer Science
in partial fulfillment of the requirements
for the degree of
BACHELOR OF SCIENCE

Cody Christopher Lirazan
2024

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Submitted to the Department of Mathematics and Computer Science
in partial fulfillment of the requirements
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BACHELOR OF SCIENCE (or ARTS)

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ABSTRACT

Cyber Forensics Murder Mystery: Fake Profiles.

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The Cyber Forensics Course at Northwest Nazarene University presents a murder mystery situation for students to investigate. Students must determine who the perpetrator is by using the information given and the tools necessary for proper examination within legal guidelines. While educational, the mystery itself is a simplistic scenario that includes emails and texts. The goal of this project is to improve the state of the current scenario by adding new material as evidence for students to sift through and analyze. The main bulk of this project was to examine different generative image models that could produce realistic human individuals and represent the characters. The second part of this project was exploring other generative models developed by multiple parties that could create images for background data. The third part was combining audio recordings that were generated from a deep learning machine, created by Eleven Labs, to produce fake phone call discussions and/or recorded messages. The three highlighted objectives were achieved with future refinement needed on the results.

ACKNOWLEDGEMENTS

I would like to thank Dr. Kevin McCarty for providing me with the opportunity to be a part of this project and expanding the course content for future students to learn from this field of study. I would also like to express gratitude for the Idaho State Police Cyber Crime Unit, for allowing me to assist in their work and understand the value of Cyber Forensics. Finally, I would like to express my thanks to my friends and family for supporting me throughout my college career at Northwest Nazarene University.

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Overview:

The purpose of this project is to create a more realistic situation for students to understand what professionals in cyber forensics must deal with daily, the procedures they follow, and the legal guidelines regarding forensics. This project aimed to provide fake profiles, images, and audio that posed as "legitimate" forms of media for students to use as evidence in their investigation. Each type of media was created through generative image or voice models that used templates for images, trained off different images to create their own, and used tools like text-to-speech to create audio recordings. Each model had a well-defined goal in the overall project. The primary objective was to create full-body individual characters that could be considered a "profile picture" on a social media platform. The secondary objective was to have generated images that reflect the character's personality, hobbies, or interests. The final objective was to provide audio recordings that could be used as phone calls or voicemail messages for the characters in the story.

Background:

Northwest Nazarene University offers a Cyber Forensics Course for students to grasp what kind of work one would have to do in the field of digital forensics. The course itself involves aspects of forensics that teach students how to handle digital evidence, the legal guidelines that come with managing digital forensics (as well as the legal ambiguity with digital forensics), and what tools are used for extracting, examining, and collecting evidence. Recently, students were given the opportunity to work with the Idaho State

Police Cyber Crime Unit for volunteer work, which would allow them to see firsthand what it would be like to work with Cyber Forensics in the professional world. Around the same time, a murder mystery investigation was being developed for the course so students could apply the skills and tools they learned over time. The murder mystery story is continuing in development as this project now includes additional material for future students to work with and examine new evidence that gives greater insight into suspects in the story.

This Person Does Not Exist

The first objective of this project was to find a suitable method for creating fake images that resembles human likeness and could pass a standard straight-face test. This began with the discovery of a tool created by Philip Wang called “This Person Does Not Exist” (Wang, 2023). This tool is a Random Face Generator that produces a single headshot of a human that does not exist anywhere because it was produced by the image generator. Figure 1 shows an example of what the tool can produce.

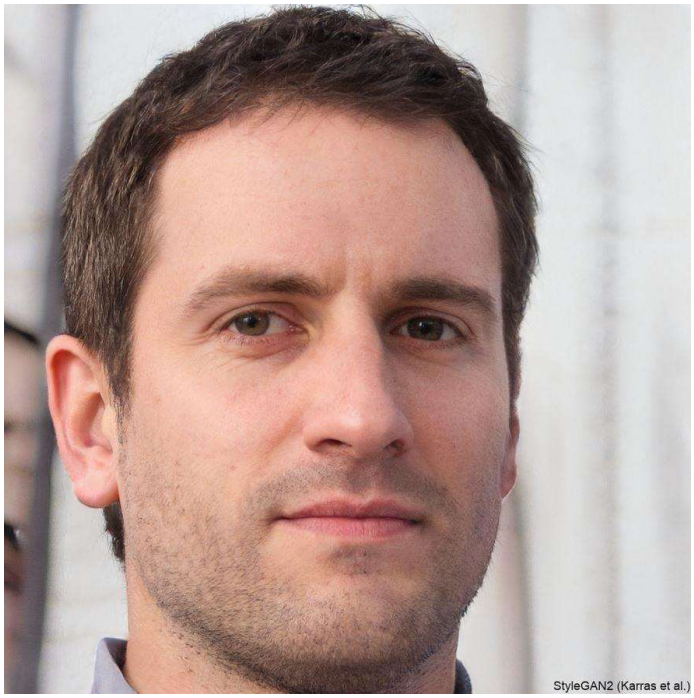


Figure 1 – TPDNE Result

The generator was based off the architecture of the StyleGAN, or the Style Generative Adversarial Network (Nvidia, 2023). Broadly speaking, the StyleGAN architecture runs two separate networks that run concurrently to produce a fake image. One is the Generator, or the network that takes a preexisting image from a given dataset and results in a new image based off the original image(s) and the points it mapped for overall appearance and style. The second network is the Discriminator, which compares the original image(s) and the generated image to determine if the generated image is real or fake (Vina, 2023). Taking that architecture, Wang applied it to his machine to produce realistic looking faces.

AI Human Generator

In Addition to the tool Wang created, creating full body generated images for each individual character was the next step. This led to the implementation of the tool known as the “AI Human Generator” (Generated Media, 2023). The Human AI Generator uses a similar GAN architecture that pulls datasets from a website called Icons8 (Future Tools, 2023). This site contains over a million different icons and visual assets to train off. The AI Human Generator can either provide a randomly generated human from scratch or give specific parameters to adjust and apply to the result. For this tool, the initial headshot that was previously generated from the TPDNE machine was applied as a parameter for the face of the generated individual.

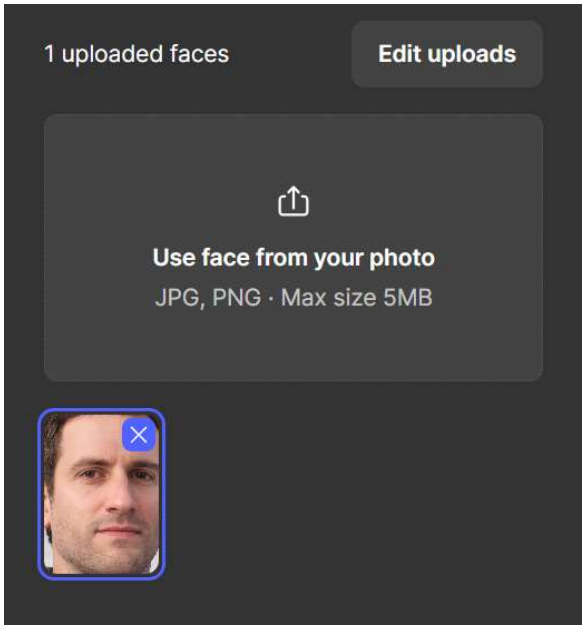


Figure 2 – Face Upload

Once the face is chosen, the generator provides several parameters to describe the individual’s desired characteristics. The parameters can include the age, the gender, the

ethnicity/skin type, the desired body type, hair color and design, clothing style and accessories, the background, and more to affect the appearance of the image. The AI Human Generator also provides a text box in the event the provided values for the parameters do not contain the desired options. Figure 3 shows an example of what a possible result could be.

Figure 3 – Generated Human

At first glance the generated human does appear to be realistic. However, there are some noticeable appearances that show some issues. For example, the arm crossing

under the other arm on top shows the individual having only two fingers, the hip to shoulder ratio is slightly off, and the lighting is off on the character compared to the background's lighting. In short, the Human Generator presents a suitable result for individuals in the investigation to have a realistic figure and appearance to their name.

DALLE Image Merge Test

Now that creating individual characters for the investigation was accomplished, the next challenge was to connect two images and combine them as one. Essentially, two images of the characters and pair them up as a couple, such as husband and wife set up. Complications arose where many of the image generators (at least the ones that were freely available to the public) did not include that capability. One AI machine that was tested for this obstacle was DALL-E, which was created by the AI research organization OpenAI. DALL-E. DALL-E is a text-to-image generator that produces images based on the captions that are given. If a paid subscription is an available option (or the route to collect more credits for generating images), tools such as Outpainting and Inpainting are provided to manipulate images. The Outpainting tool offers a way to add to the current image and expand beyond it, While the Inpainting tools includes the ability to add or subtract elements from the original image (OpenAI, 2024). The problem was that none of the tool's DALL-E provided were able to take two existing images and combine them into something new. Another prominent AI Image generator was Midjourney, which had the capability to blend two images to make a new image (Midjourney, 2023). However, Midjourney does not have the current abilities to make the couple images that was

desired for this project. It's only capable of combining two images (say a Vincent Van Gogh painting and an image of the current President) to produce a brand-new image (The president in a Vincent Van Gogh painting), so the images are static and do not result in a dynamically changed image.

This Beach Does Not Exist

Creating and producing fake images of the characters was accomplished. Now that the results for the portrayal of the characters in the story was obtained, the next objective was to work on providing additional media that could represent or reflect the characters and their personalities in some way. One of those involved the discovery of a site known as "This Beach Does Not Exist" created by Vojtech Semecky. Like the TPDNE tool created by Philip Wang, Semecky used StyleGAN2-Ada architecture created by Nvidia to generate his images. According to Semecky, he trained off a dataset of roughly twenty thousand images for his machine to produce proper realistic images of beaches. The network was trained until it had seen and produced twenty-five million images so that it could begin producing images that could pass represent a realistic location (Semecky, 2023).

Figure 4 – Generated Beach

The image presents a tropical beach side with larger boulders with brush and balm tress behind them, along with a possible island or two in the distance. Once again, the result is not perfect as there are imperfections with the sky, palm trees, or boulders blended. Despite small parts appearing unnatural, the image itself shows a clear depiction of what a beach looks like, or at least what it was trained off in the first place.

This Automobile Does Not Exist

Another image generator that also uses StyleGAN is a tool created by James Park called “This Automobile Does Not Exist”. This network generates a random vehicle based of the dataset it trained off (Park, 2023).

Figure 5 – Generated Automobile

The network generated a realistic modern vehicle that could act as one of the character’s vehicles. Notice the image blending with the trees and the concrete background, as well as the edge of the front of the vehicle being slightly deformed. Images like the generated vehicles can be used for further evidence and background in the student’s investigation into the characters.

This Campsite Does Not Exist

Another image generator that was also explored is called “This Campsite Does Not Exist”. Created by Andy Feliciotti, this image generator uses Stable Diffusion instead of the StyleGAN that the other previous AI image generators have used. The Stable Diffusion model differs from StyleGAN in that it applies diffusion techniques, such as using noise to encode an image and recreating the image through a noise predictor (Amazon Web Services, 2024), instead of utilizing two separate networks to train with. The site is updated with a newly generated campsite every hour using the Stable Diffusion model (Feliciotti, 2023).

Figure 6 – Generated Campsite

Figure 6 represents a result of the model, showing off a foreground with a flat field and tents followed by a background of a mountain range. Feliciotti provides a desired dataset for his model to work off to recreate and generate a new image in a nonexistent location. Machines like this can also include background information for the character's possible interests or hobbies like camping.

This Mountain Does Not Exist

Much like the campsite image generator, the site "This Mountain Does Not Exist" uses the Stable Diffusion model to produce realistic images of nonexistent mountain locations.

Figure 7 – Generated Mountain

Created by Kirusanth Poopalasingam, the results include a mountain range of some kind with additional foreground possibly being a lake, hills, valleys, or an extension of the generated mountain range (Poopalasingam, 2023). Figure 7 showcases a realistic

mountain range in the background leading to a lake in the middle of the foreground. Like the other sites and AI generative tools, this site could also provide more context into the character's lifestyle, personality, and hobbies for students to investigate.

While the images offer extra details about the lives of the characters, the images can also be involved in other areas of cyber forensics. One example is using images for steganography, or the method of hiding encoded messages or data in images through binary shifting. With the provided images showcased, students can use forensic techniques and applications to decipher and examine the images more closely to determine if messages or data are hidden.

Generative Voices – Eleven Labs

The main objective of the project was to produce fake images of characters for their profiles, along with additional generated images for background information into their lifestyle. The final objective was to examine and explore possible forms of AI voice generators to provide for the characters in the investigation. Specifically, the goal was to mimic a phone call between two possible suspects, rather than just having emails for evidence. This led to the discovery of Eleven Labs, a research company that specializes in voice generating and development (Eleven Labs, 2024). The company provides various options for pre-recorded voices to choose from. The pre-made voice options Eleven Labs offers includes a wide variety based on the age, gender, and accent of the voice that is desired for the speech.

Text – To – Speech

They also include different methods of producing results. One of these methods is using a text-to-speech model for the voice selected to speak the written prompt. The Text – To – Speech allows the choice of the current speech synthesis model to run and the type of voice that is desired. As stated previously, the voices include gender and accent for each character, the description or type of speech, and the user case for that speech. The user case for each voice represents how the speech is portrayed. An example of a pre-recorded voice Eleven Labs created was used.

Figure 8 – Pre-Recorded Voice Options

In the figure above the voice chosen was Chris, who has an American accent with a casual style in their speech that is more conversational in their approach. This is one of many alternatives that can be selected based on what speech is desired and the context for said speech. Once the voices are chosen, the model is then fed text for it to read off and produce an audio recording of the voice speaking.

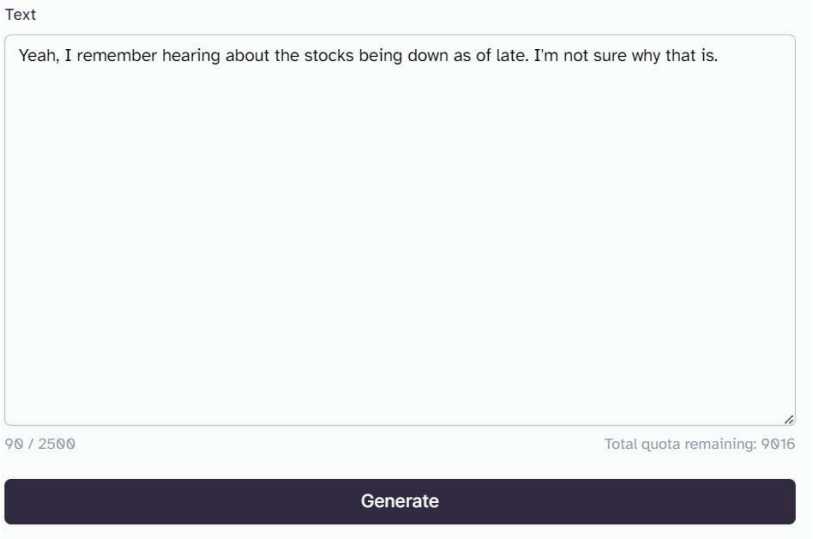


Figure 9 – Text Box

The text box provided shows what can be written for the recorded voice to speak. Note that on the bottom left corner of the text box is a limit to how many characters can be spoken in a single generated recording, and on the bottom right is the total amount of characters left to be used. This is due to the subscription-based system when making an account, where newcomers are set to the free subscription with have ten thousand characters to spend per month, or ten minutes of audio. With this voice synthesis tool, the characters in the story can now have voices attributed to them and give more personality to each of them.

Speech – To – Speech (Dubbing)

The Text – To – Speech model is a solid approach with many pre-recorded options to settle with, but what if the site does not offer the voice that is being searched for? Well Eleven Labs offers an alternative option to design a voice by adjusting certain parameters, such as the age, gender, and accent, to create the ideal voice. If the parameters contain nothing that is desired, Eleven Labs also includes the capability to

create clones of voices that were selected for uploading. According to Eleven Labs and their research, cloning is almost instantaneous, but remains slightly dependent on the AI containing prior knowledge from previous training data. In any case, Eleven Labs provides multiple approaches for finding the ideal voice. This allows the characters in the investigation to have distinct voices connected to them without having repetitive voices representing multiple characters.

Audio Stitching

Now that voices and audio recordings could be obtained for each individual character, the final step now is to combine the recordings and make a typical conversation similar to a phone call. To accomplish this, an audio clipping application was used to combine multiple audio files together to create one long audio file. Clideo, a website that offers multiple applications for editing videos, images, and audio files was selected to stitch the audio files together (Clideo, 2024). Clideo includes a tool that can merge multiple audio files or videos together to make one audio file or video.

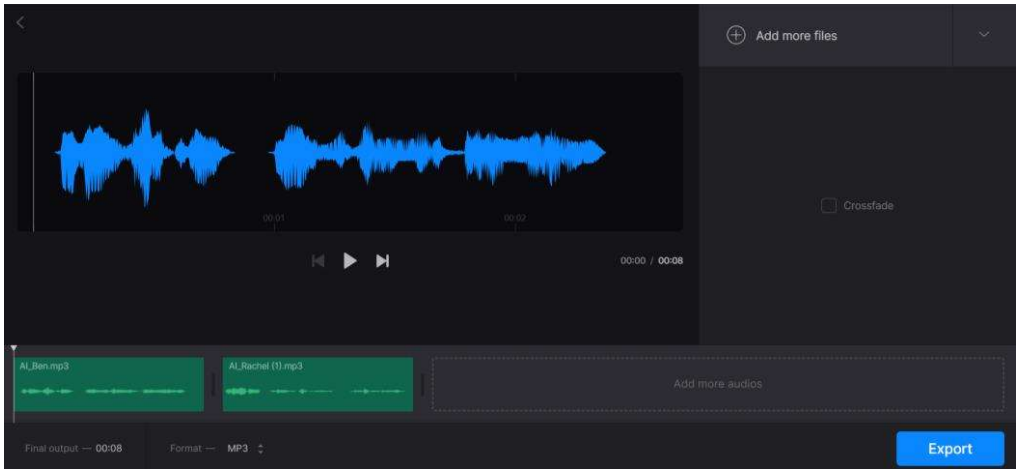


Figure 10 – Clideo Audio File Merge

As seen from the figure, it just takes a minimum of two audio files to select and combine to create a new file. Using this application, dialogue between characters could be included in the investigation so students can connect suspects with one another. The process for stitching files can be repeated until the dialogue exchange is satisfactory for mimicking a conversation.

Results

In total, there were three objectives that were applied to this project and ultimately accomplished. The first was to research and discover methods of creating and generating fake humans that could be considered profile images and reflect the characters in the investigation for the Cyber Forensics Course. The second was finding miscellaneous material or media that could also be replicated and generated to provide background information on the characters, as well as using the images for additional purposes. One of these purposes involves using steganography for students to examine the images on a deeper level and decipher. The third and final objective was to create audio recordings and messages that could be applied to each individual character. From that, audio recordings could be combined to create fake scenarios of phone conversations or messages playing out for students to analyze and use as evidence.

Future Work

The results proved to be a success for this project. However, there is always room for improvement with the generated images. The overall goal in the future is to produce more of the same images that were shown, as this was just the start of an ongoing project. The current AI generated Humans are not perfect and should be looked at to improve their current state. While it is effective at producing quick results, the realistic factor should be adjusted and fine-tuned in the future. Additionally, the miscellaneous images that were generated from other sites and sources could also be looked at as well. While some of the images produced were good quality, some of the images like the Automobiles showed obvious signs of struggle in the generation of the image. If needed, Dall-E does produce high quality images that could replace some of these tools to improve the state of the generated images. The audio recordings could also be adjusted and investigated further as well. As stated, the main goal is to create additional media, since this project is just a start. The audio recordings in this project were meant to show the capability of adding and applying voices to the characters for a more realistic scenario. The future requires actual application of this method, with voices being designated for each individual character, and developing scenarios where students can examine audio files with dialogue between suspects.

Conclusion

This project has been a true joy to work on as it not only helped me improve my understanding in other areas of Computer Science, but it also allowed me to contribute to the studies and learning for other students in the future. Through this project I was able to collaborate and work with Dr. Kevin McCarty and Trent Ferguson. The joint effort to get this project started and rolling was an amazing journey and experience that really motivated me to improve the state of the Cyber Forensics Course. The work that all the people did with the AI image and voice generators has been a true path of learning for me. Because of this project, I have been able to dive deeper into the realm of how AI images and voices are trained. In the end, I have gained and learned so much from this senior project that not only has benefited me but has also benefited future students to examine and consider looking into.

REFERENCES:

Wang, P. (2023). *Random Face Generator (This Person Does Not Exist)*. Random Face Generator: This Person Does Not Exist. Retrieved September 2023, from https://this-person-does-not-exist.com/en

Vina A. (2023, June 27). *What is StyleGAN-T? A Deep Dive*. Roboflow Blog. Retrieved January 2024, from https://blog.roboflow.com/stylegan-t/

Nvidia. (2021, October 28). *StyleGAN – Official TensorFlow Implementation*. Github. Retrieved November 2023, from https://github.com/NVlabs/stylegan/blob/master/README.md

Generated Media. (2023). *Turn God Mode On. Meet Human Generator*. Generated Photos. Retrieved September 2023, from https://generated.photos/human-generator/?ref=futuretools.io

AI Human Generator (2023). Future Tools. Retrieved February 2024, from https://www.futuretools.io/tools/ai-human-generator

OpenAI. (2024). *Transforming work and creativity with AI*. OpenAI. Retrieved January 2024, from https://openai.com/product

Midjourney. (2023) *Blend*. MidJourney. Retrieved November 2023 from https://docs.midjourney.com/docs/blend-1

Semecky, V. (2023) *This beach does not exist*. This beach does not exist. Retrieved September 2024, from https://thisbeachdoesnotexist.com/

Park, J. (2023) *This Automobile Does Not Exist*. This Automobile Does Not Exist. Retrieved October 2023, from https://www.thisautomobiledoesnotexist.com/

Feliciotti, A. (2023) *This Campsite Does Not Exist*. This Campsite Does Not Exist. Retrieved October 2023, from https://thiscampsitedoesnotexist.com/

Amazon Web Services. (2024). What is Stable Diffusion. Amazon. Retrieved February 2024, from https://aws.amazon.com/what-is/stable-diffusion/

Poopalasingam, K (2023) *This Mountain Does Not Exist*. This Mountain Does Not Exist. Retrieved October 2023, from https://thismountaindoesnotexist.com/

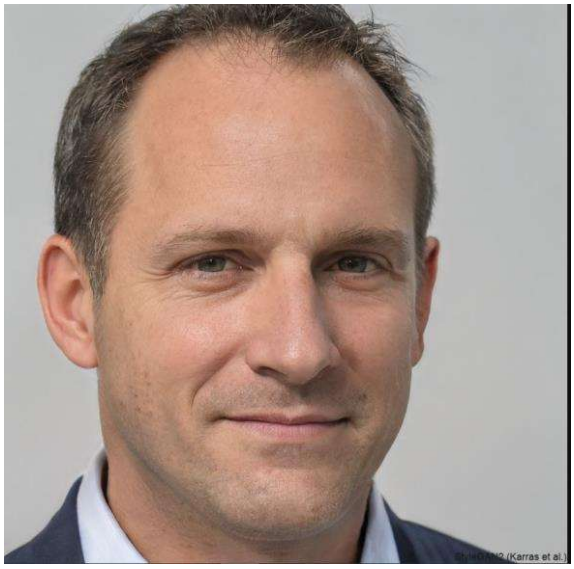
Eleven Labs. (2024). *Generative Voice AI*. Eleven Labs. Retrieved January 2024, from https://elevenlabs.io/

Clideo. (2024). *Merge Videos*. Clideo. Retrieved January 2024, from https://clideo.com/merge-video

APPENDICES:

Appendix A: AI Human Images

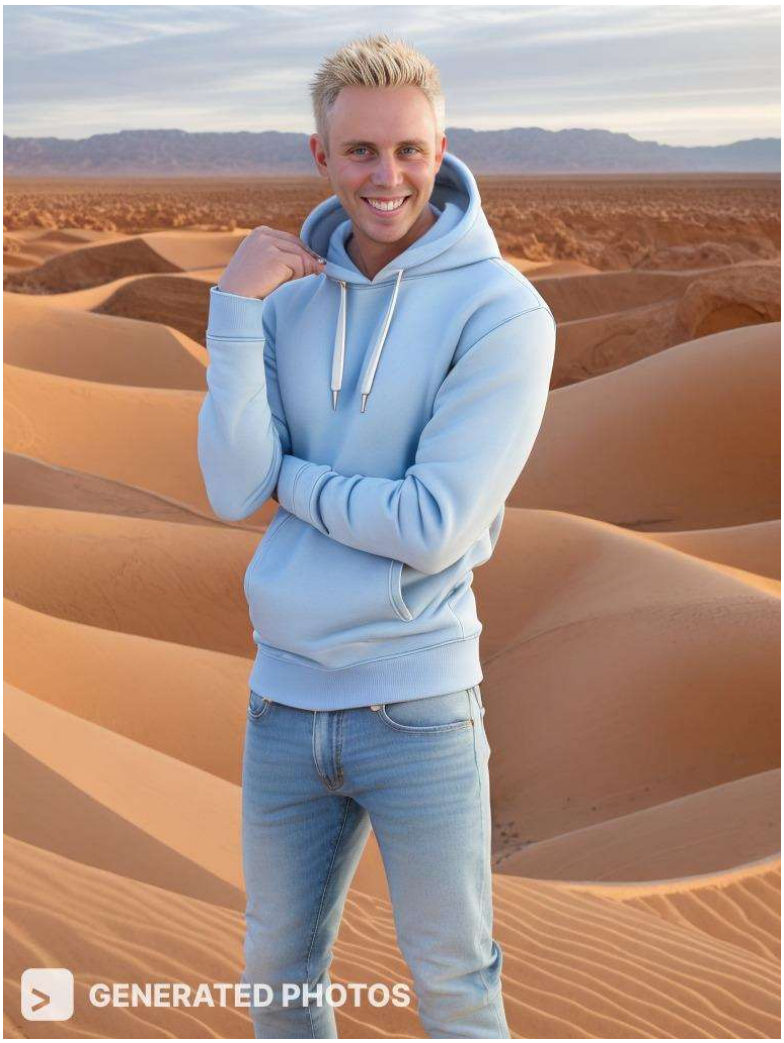
TPDNE Image Test #1



TPDNE Image Test #2

AI Human Generator – Attempt 1

AI Human Generator – Attempt 2



AI Human Generator – Attempt 3

AI Human Generator – Attempt 4

AI Human Generator – Attempt 5

AI Human Generator – Attempt 6

AI Human Generator – Attempt 7

AI Human Generator – Attempt 8

AI Human Generator – Attempt 9

AI Human Generator – Attempt 10

Appendix B: AI Miscellaneous Images

AI Generated Beach – Attempt #1

AI Generated Vehicle – Attempt #1

AI Generated Vehicle – Attempt #2

AI Generated Vehicle – Attempt #3

AI Generated Campsite – Attempt #1

AI Generated Mountain – Attempt #1

Appendix C: Audio Files


Rachel-Ben.mp3


AI_Rachel (1).mp3


AI_James_Response.mp3


AI_James_Bella.mp3


AI_James.mp3


AI_Freya.mp3


AI_Freya&Chris.mp3


AI_Chris.mp3

Al_Ben.mp3

Al_Bella.mp3