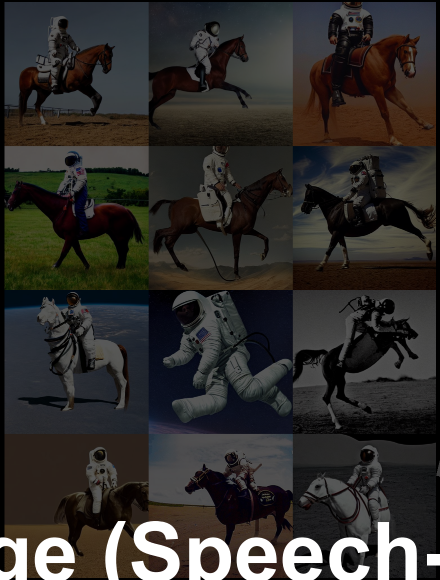

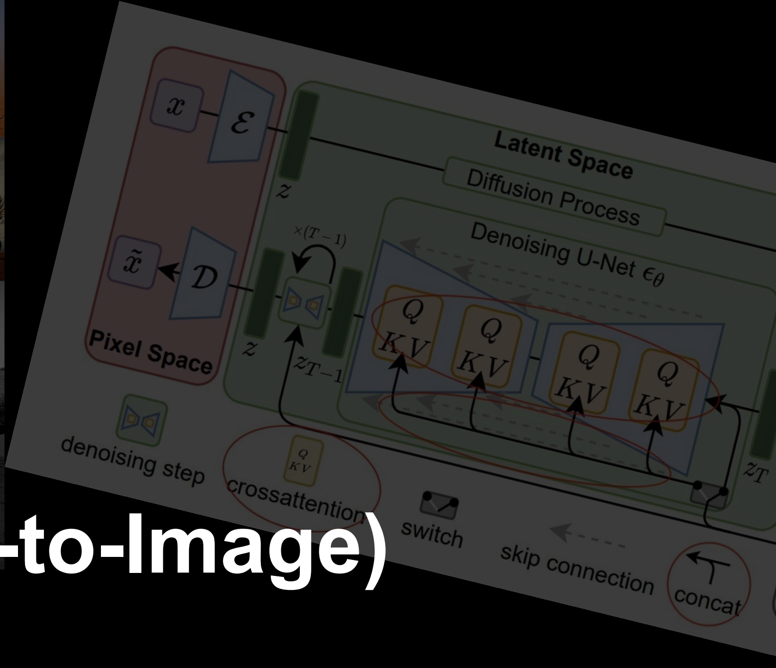

Speakage (Speech-to-Image)

TEAM #5

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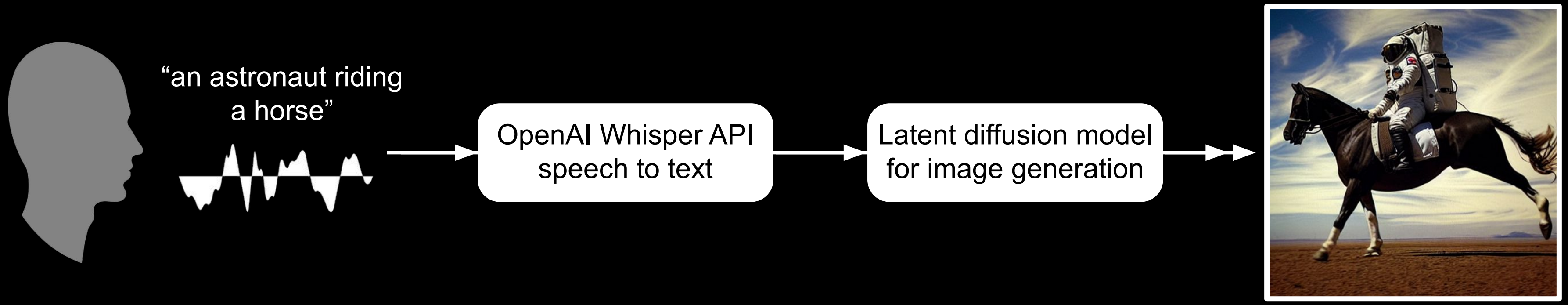
Problem Statement



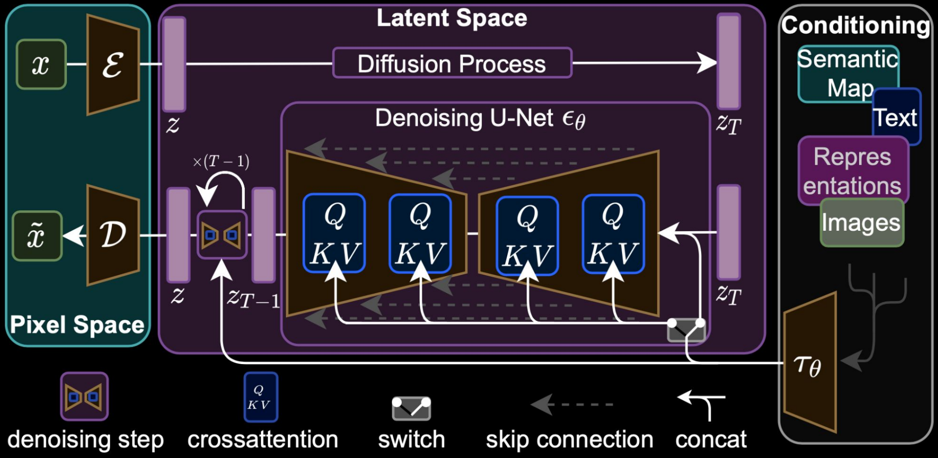
- Traditional GAN techniques may run into “mode-collapse” during image generation
- We use diffusion based models to “generate an image from speech”
- Used transfer learning to train diffusion model on our custom dataset

Algorithms & Approaches

- Model - Pre Trained Latent Diffusion Model from Stable Diffusion

- Training data - Custom data set containing 30 images of Affan resized to 256x256x3 preserving aspect ratio

- Training hyperparameters:
  - Learning rate: 1.0e-06
  - Training Steps: 2000
  - Batch Size: 1
  - Optimizer: Adam



$$\mathbb{E}_{\mathbf{x},\mathbf{c},\epsilon,t}\left[w_t\|\hat{\mathbf{x}}_\theta(\alpha_t\mathbf{x}+\sigma_t\epsilon,\mathbf{c})-\mathbf{x}\|_2^2\right]$$

Loss function (Perception Loss)

Algorithms & Approaches

Approach:

- This method takes a few images of a subject (Affan) and the corresponding class name (Person), and returns a fine-tuned/"personalized" text-to-image model that encodes a unique identifier that refers to the subject.

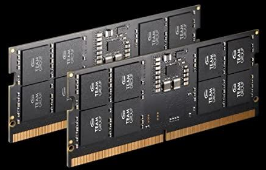
- Fine tuning the low-resolution text-to-image model with the input images by applying a class-specific prior to preservation loss

- Inference with a text prompt containing a unique identifier and the name of the class the subject belongs (Eg: Affan Person ….)

Implementation

- **<u>Step 1</u>:** System Requirements
  - RTX 3090 GPU
  - 24 GB RAM

```
requirements
omegaconf
einops
pytorch-lightning==1.6.5
test-tube
transformers
kornia
-e git+https://github.com/CompVis/taming-transformers.git
transformers
-e git+https://github.com/openai/CLIP.git@main#egg=clip
setuptools==59.5.0
pillow==9.0.1
torchmetrics==0.6.0
-e .
protobuf==3.20.1
gdown
-qq diffusers["training"]==0.3.0 transformers ftfy
-qq "ipywidgets>=7,<8"
huggingface_hub
ipywidgets==7.7.1
captionizer==1.0.1
```



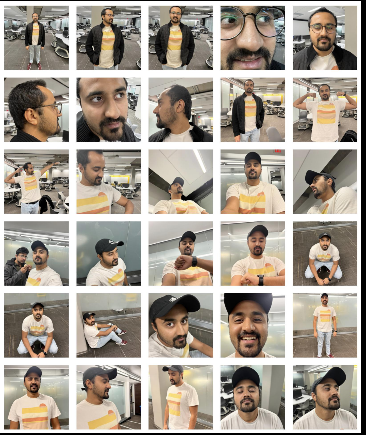
- **<u>Step 2</u>**: Install dependencies
  - [Requirements.txt]

- **<u>Step 3</u>**: Obtain an open source weight file
  - [Pre trained weights]

Hugging Face

Implementation

- **Step 4**: Data preparation
  - [Custom dataset]
  - Token = Custom name (Affan)
  - Class = Person
- **Step 5**: Download token images
  - Custom (Affan's) pictures



```
Running DDIM Sampling with 50 timesteps

DDIM Sampler:   0%|          | 0/50 [00:00<?, ?it/s]
DDIM Sampler:   2%|          | 1/50 [00:00<00:06,  7.87it/s]
DDIM Sampler:   4%|          | 2/50 [00:00<00:05,  8.05it/s]
DDIM Sampler:   6%|          | 3/50 [00:00<00:05,  8.12it/s]
DDIM Sampler:   8%|          | 4/50 [00:00<00:05,  8.16it/s]
DDIM Sampler:  10%|          | 5/50 [00:00<00:05,  8.18it/s]
DDIM Sampler:  12%|          | 6/50 [00:00<00:05,  8.19it/s]
DDIM Sampler:  14%|          | 7/50 [00:00<00:05,  8.19it/s]
DDIM Sampler:  16%|          | 8/50 [00:00<00:05,  8.20it/s]
DDIM Sampler:  18%|          | 9/50 [00:01<00:05,  8.19it/s]
DDIM Sampler:  20%|          | 10/50 [00:01<00:04,  8.19it/s]
DDIM Sampler:  22%|          | 11/50 [00:01<00:04,  8.20it/s]
DDIM Sampler:  24%|          | 12/50 [00:01<00:04,  8.19it/s]
DDIM Sampler:  26%|          | 13/50 [00:01<00:04,  8.20it/s]
DDIM Sampler:  28%|          | 14/50 [00:01<00:04,  8.20it/s]
DDIM Sampler:  30%|          | 15/50 [00:01<00:04,  8.21it/s]
DDIM Sampler:  32%|          | 16/50 [00:01<00:04,  8.21it/s]
DDIM Sampler:  34%|          | 17/50 [00:02<00:04,  8.20it/s]
DDIM Sampler:  36%|          | 18/50 [00:02<00:03,  8.20it/s]
DDIM Sampler:  38%|          | 19/50 [00:02<00:03,  8.19it/s]
DDIM Sampler:  40%|          | 20/50 [00:02<00:03,  8.19it/s]
DDIM Sampler:  42%|          | 21/50 [00:02<00:03,  8.19it/s]
DDIM Sampler:  44%|          | 22/50 [00:02<00:03,  8.19it/s]
DDIM Sampler:  46%|          | 23/50 [00:02<00:03,  8.19it/s]
DDIM Sampler:  48%|          | 24/50 [00:02<00:03,  8.20it/s]
DDIM Sampler:  50%|          | 25/50 [00:03<00:03,  8.20it/s]
DDIM Sampler:  52%|          | 26/50 [00:03<00:02,  8.20it/s]
DDIM Sampler:  54%|          | 27/50 [00:03<00:02,  8.19it/s]
DDIM Sampler:  56%|          | 28/50 [00:03<00:02,  8.20it/s]
DDIM Sampler:  58%|          | 29/50 [00:03<00:02,  8.19it/s]
DDIM Sampler:  60%|          | 30/50 [00:03<00:02,  8.19it/s]
DDIM Sampler:  62%|          | 31/50 [00:03<00:02,  8.18it/s]
DDIM Sampler:  64%|          | 32/50 [00:03<00:02,  8.18it/s]
DDIM Sampler:  66%|          | 33/50 [00:04<00:02,  8.19it/s]
DDIM Sampler:  68%|          | 34/50 [00:04<00:01,  8.20it/s]
DDIM Sampler:  70%|          | 35/50 [00:04<00:01,  8.20it/s]
DDIM Sampler:  72%|          | 36/50 [00:04<00:01,  8.20it/s]
DDIM Sampler:  74%|          | 37/50 [00:04<00:01,  8.21it/s]
DDIM Sampler:  76%|          | 38/50 [00:04<00:01,  8.20it/s]
DDIM Sampler:  78%|          | 39/50 [00:04<00:01,  8.20it/s]
DDIM Sampler:  80%|          | 40/50 [00:04<00:01,  8.19it/s]
DDIM Sampler:  82%|          | 41/50 [00:05<00:01,  8.18it/s]
DDIM Sampler:  84%|          | 42/50 [00:05<00:00,  8.18it/s]
DDIM Sampler:  86%|          | 43/50 [00:05<00:00,  8.18it/s]
```

- **Step 6**: Download class dataset
  - Person_ddim
- **Step 7**: [Run training]
  - Obtain [new weights] file
- **Step 8**: Prompt for new image generation

Results

“Affan person as a masterpiece portrait painting by John Singer Sargent in the style of Rembrandt”

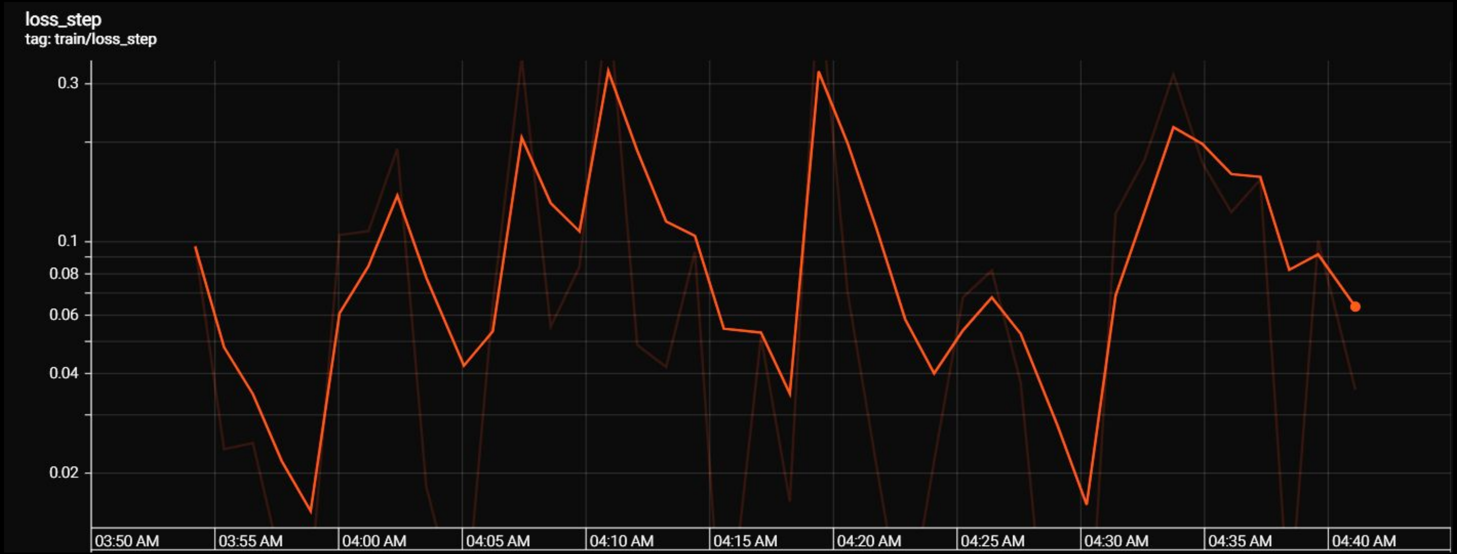
“Affan person eating a pizza painting by John Singer Sargent in the style of Rembrandt”

“Affan person eating chocolate icecream hyperrealistic“

“Affan riding a motor bike on a highway hyper realistic”

“Affan skydiving from a plane“

Results



Training loss after 2000 steps is 0.03

Training the model for higher number of steps will saturate the loss at a value closer to zero.

The process took 46 minutes for 2000 steps

Applications

- Photography and painting Inspiration
- Computer Aided Design
- Fortnite emotes

Demonstration

- The following video demonstrates the whole process of generating an image from a speech prompt
  - Uses new weights
  - Generates image incorporating custom dataset

Video - click here

Questions?

THANK YOU!