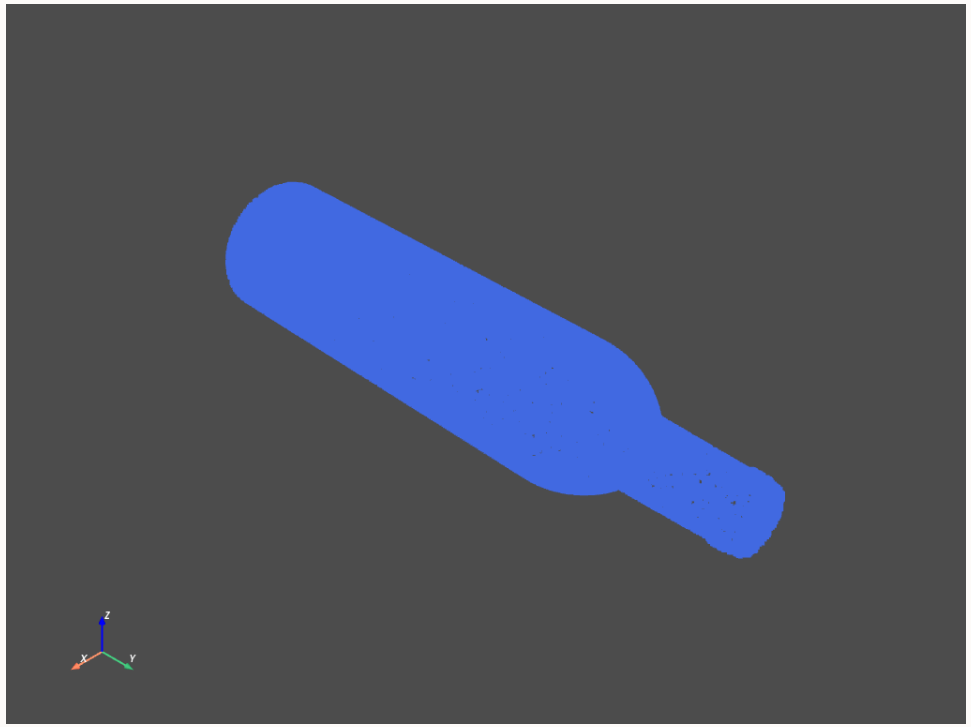
3-D Style Transfer

Jui Shah and Yamini Kashyap

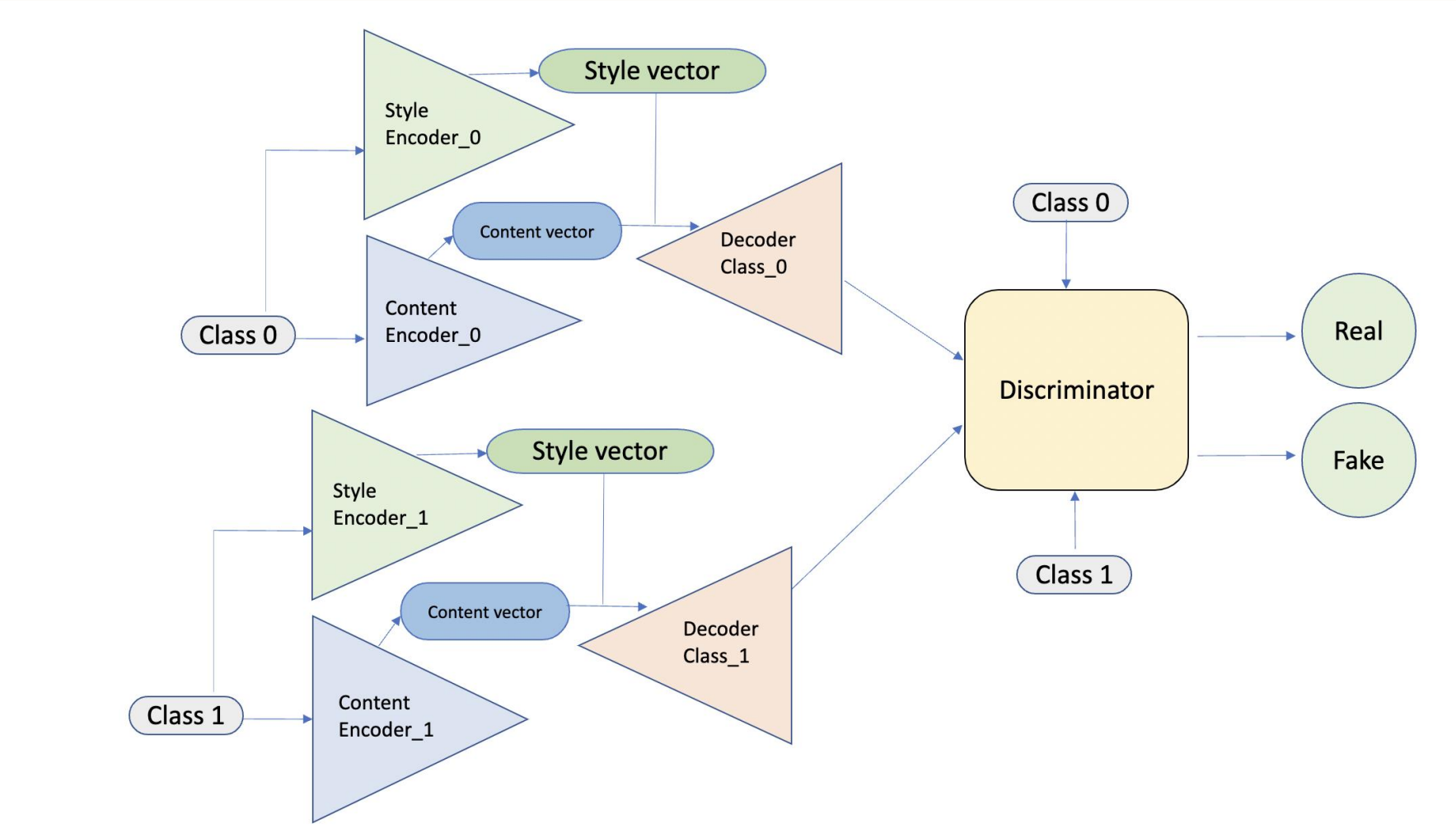
Original point clouds

Jug



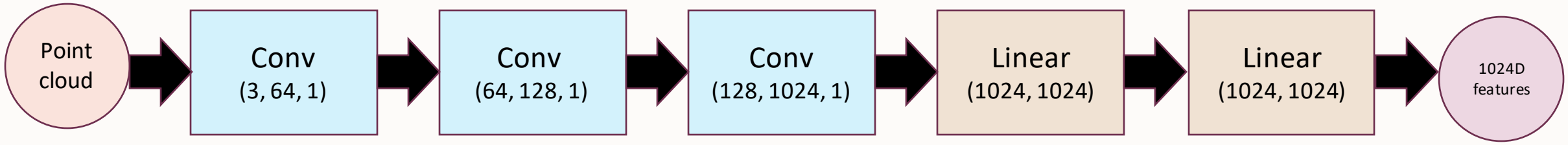
Bottle

High-level architecture

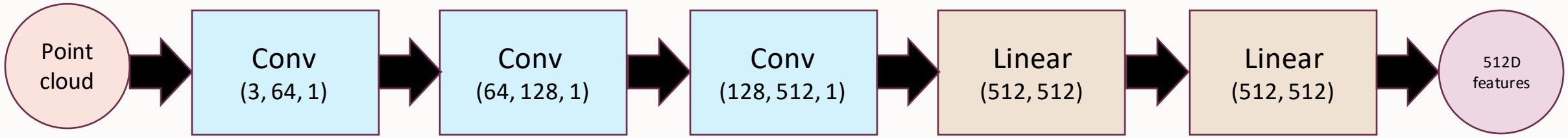


Low-level architecture (Encoder)

- Content Encoder (CNN PointNet w/ BatchNorm and LeakyReLU)



- Style Encoder (CNN PointNet w/ BatchNorm and LeakyReLU)

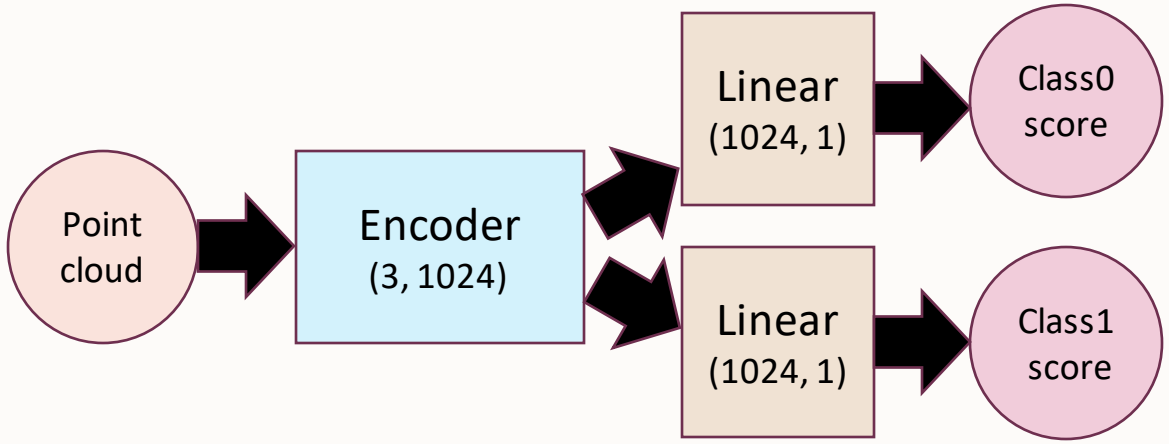


[Architecture reused and modified from 3DSNet by Mattia Segu et.al.]

Low-level architecture (Decoder and Discriminator)

- Decoder
  - StyleAtlasNet [Architecture reused from AtlasNet by Thibault Groueix et.al.]

- Discriminator (Encoder architecture same as content encoder)



[Architecture reused and modified from 3DSNet by Mattia Segu et.al.]

3DSNet Proposals

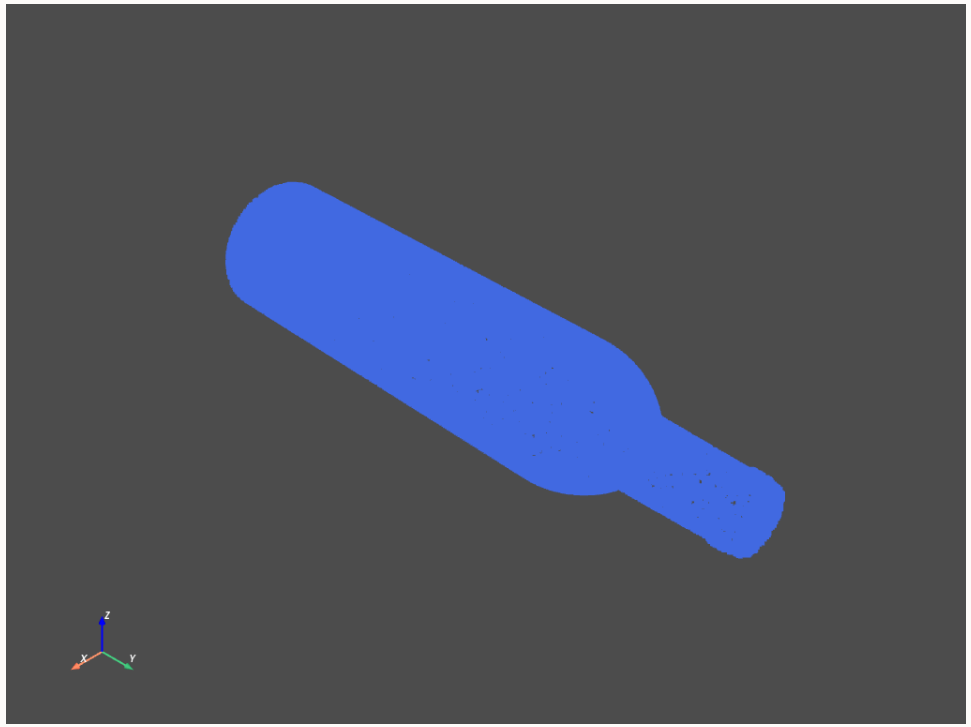
- Encoder
  - Exclusive content encoder for each class w/ BatchNorm and ReLU
  - Style encoder shared among both classes
- Decoder
  - Excusive AtlasNet for each class w/ Adaptive BatchNorm
- Discriminator
  - Shared encoder among both classes
  - Exclusive MLP for each class

Deviations(highlighted in red)

- Encoder
  - Exclusive content encoder for each class w/ BatchNorm and Leaky ReLU
  - Style encoder shared among both classes(implementation 2)
  - Separate style encoders for each class(implementation 1)
- Decoder
  - Excusive AtlasNet for each class w/ BatchNorm
- Discriminator
  - Shared encoder among both classes
  - Exclusive MLP for each class
- We have added style and content encoder reconstruction loss

Original point clouds

Jug

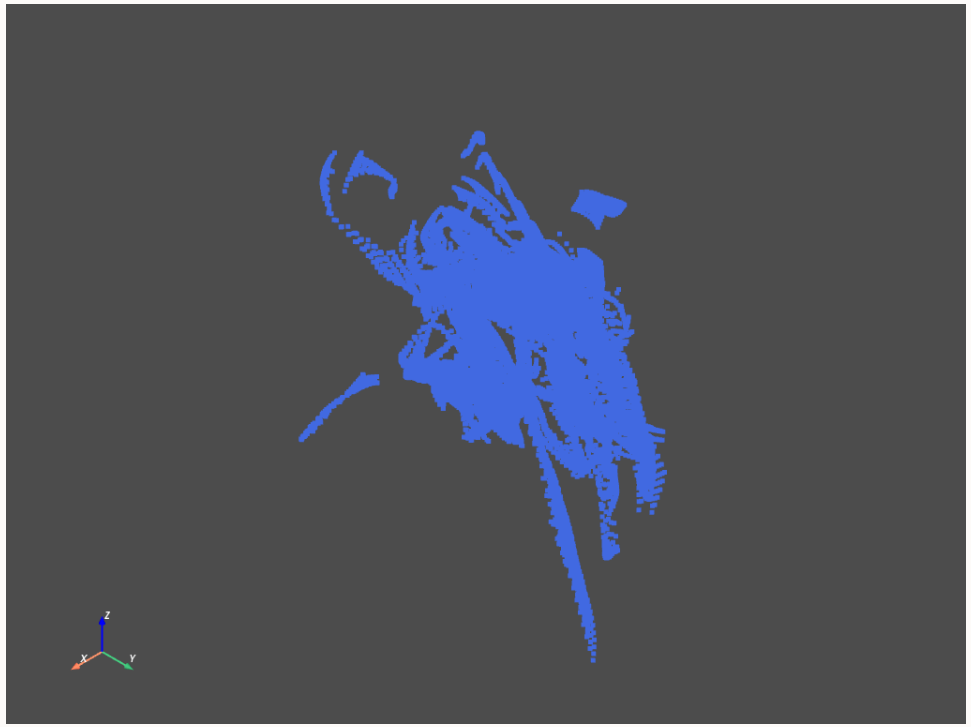


Bottle

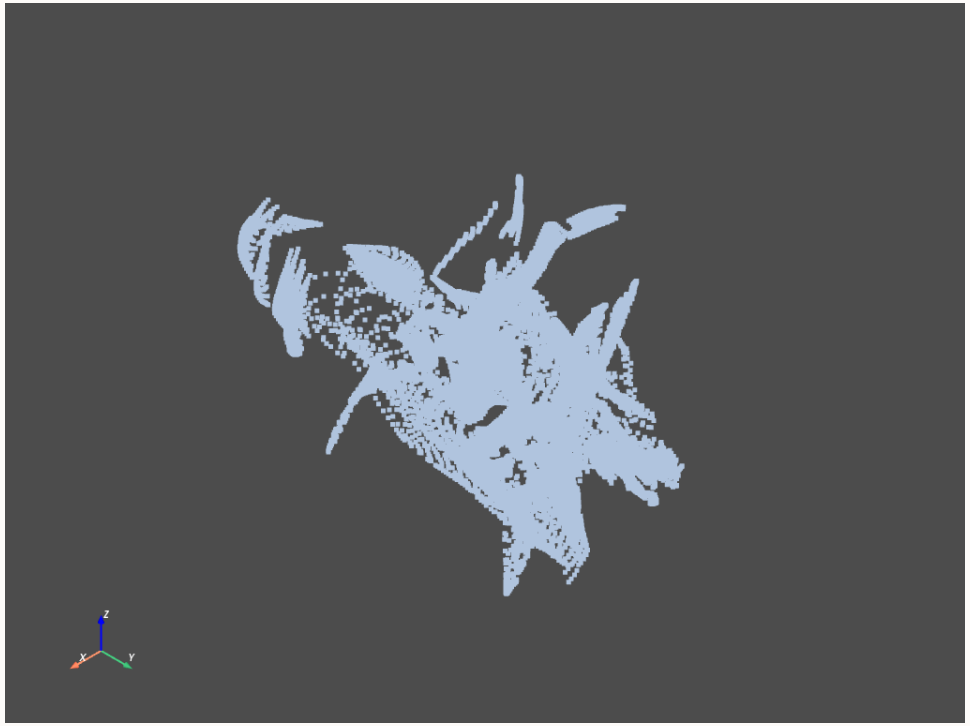
Implementation 1

- Observed exclusion of features across classes

Reconstructed bottle via style transfer



Content: bottle
Style: bottle



Content: bottle
Style: jug

Reconstructed jug via style transfer

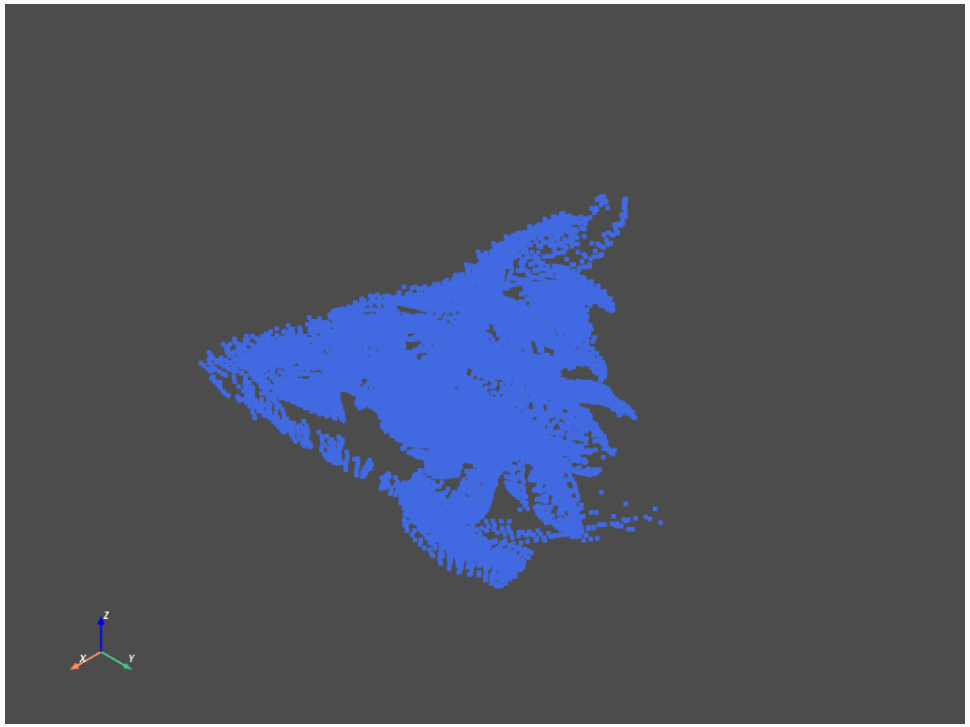
Content: jug
Style: jug

Content: jug
Style: bottle

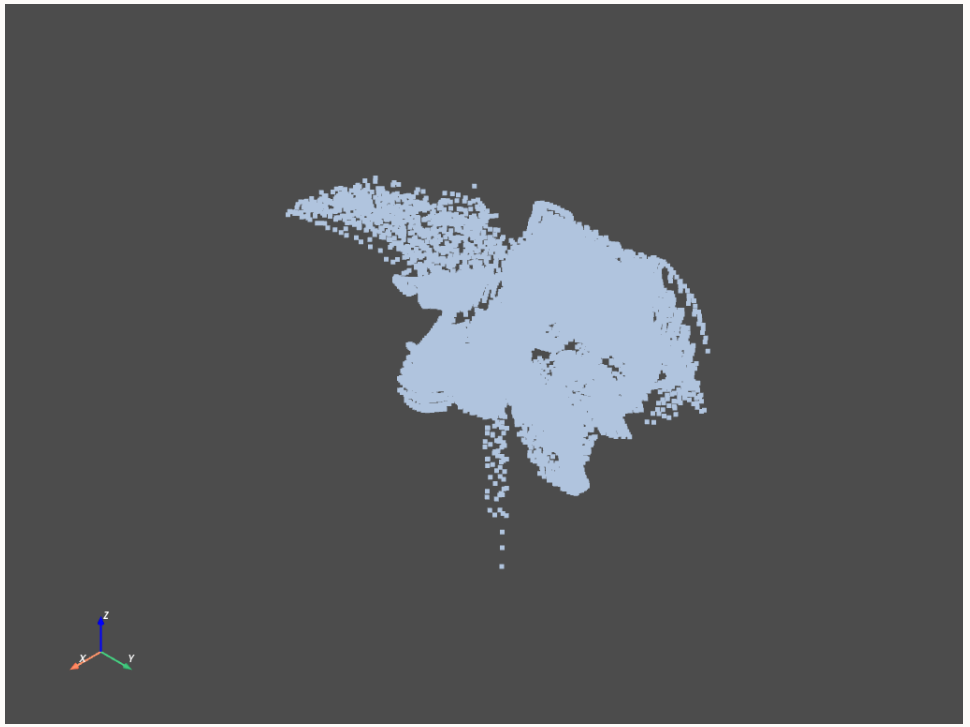
Implementation 2

- Observed intermixing of features across classes – possibly due to shared style encoding latent space

Reconstructed bottle via style transfer

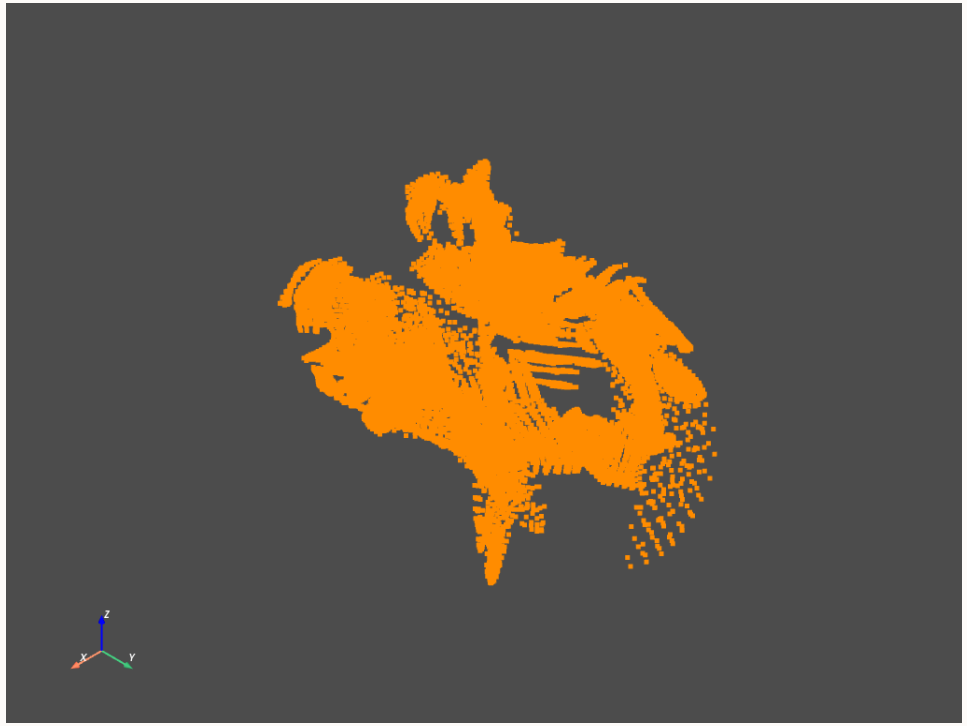


Content: bottle
Style: bottle



Content: bottle
Style: jug

Reconstructed jug via style transfer



Content: jug
Style: jug

Content: jug
Style: bottle

Conclusion

- Style Transfer with different style encoder is better than with common encoder
- A stark bottleneck - 30000 points via our decoder because of computational limitations.
- So, it certainly is not farfetched to say that with adequately hyper parameterized code and better computational resources, a really good style transfer can be achieved for 3D point clouds using our implementation as an inspiration.

Thank you!