Human Context Recognition:
A Controllable GAN Approach

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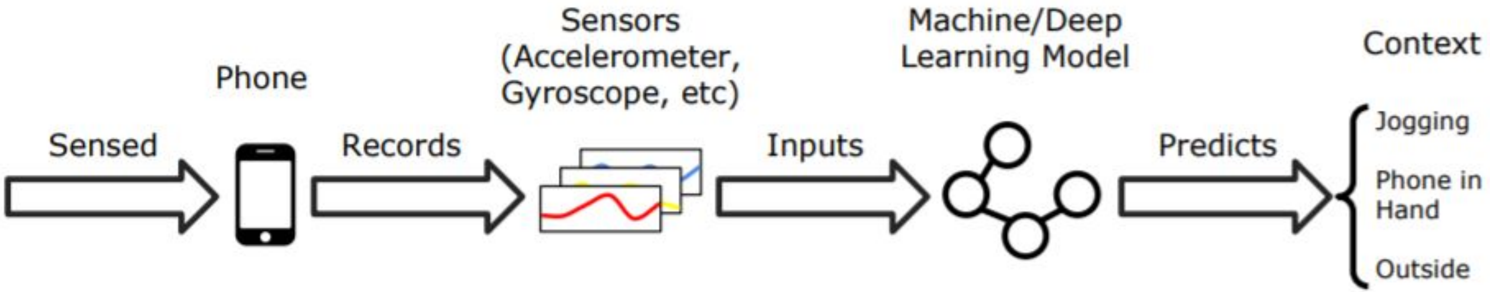
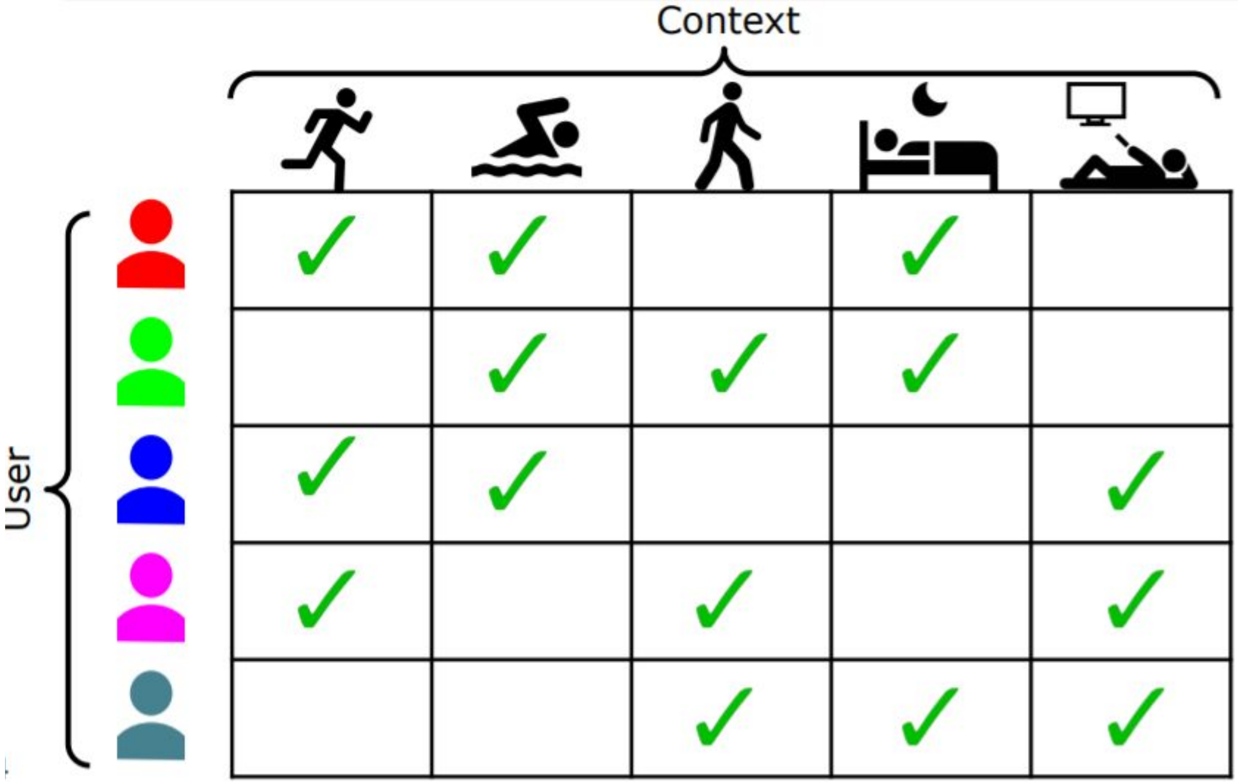
Project Overview



Use cases

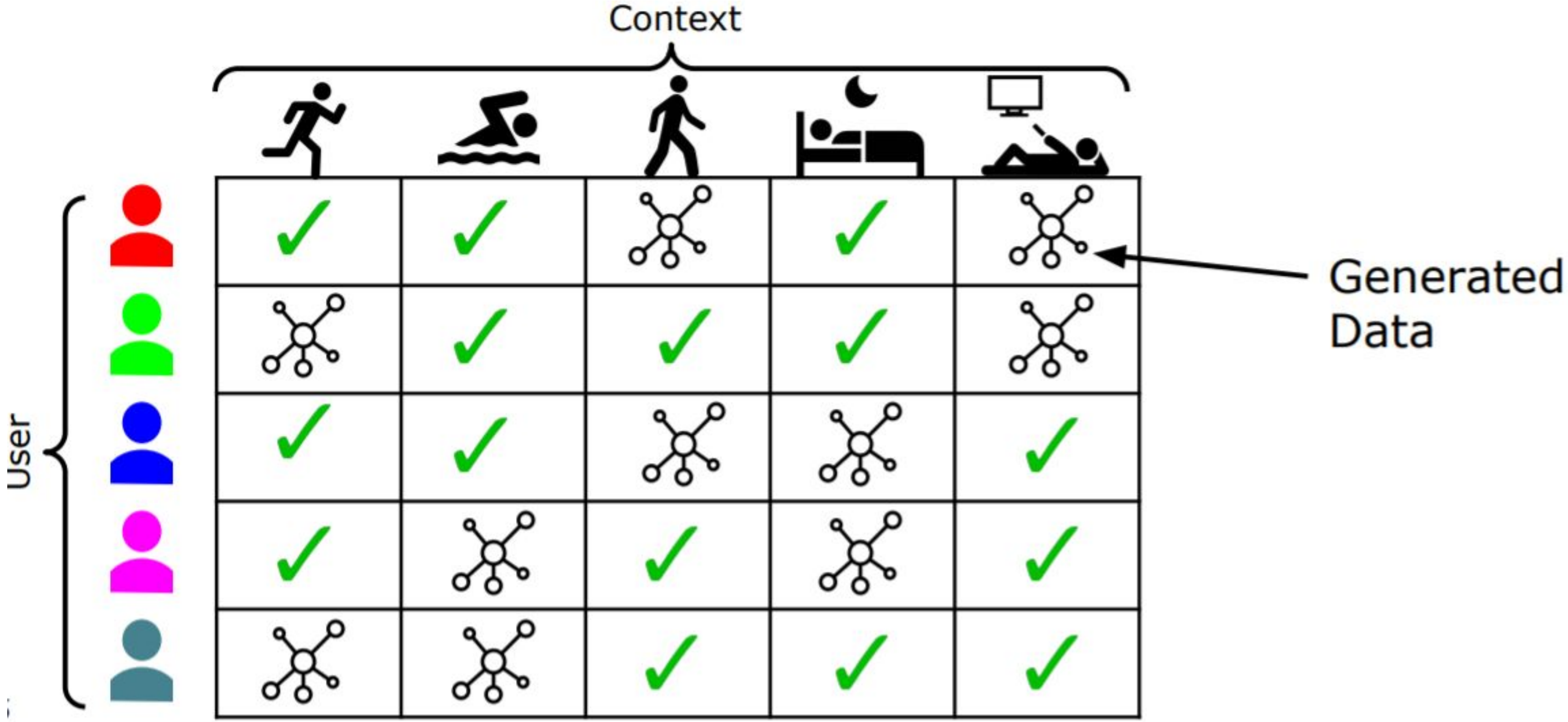
- Mobile healthcare
- Security/User Identification

Missing User-Context Pairs

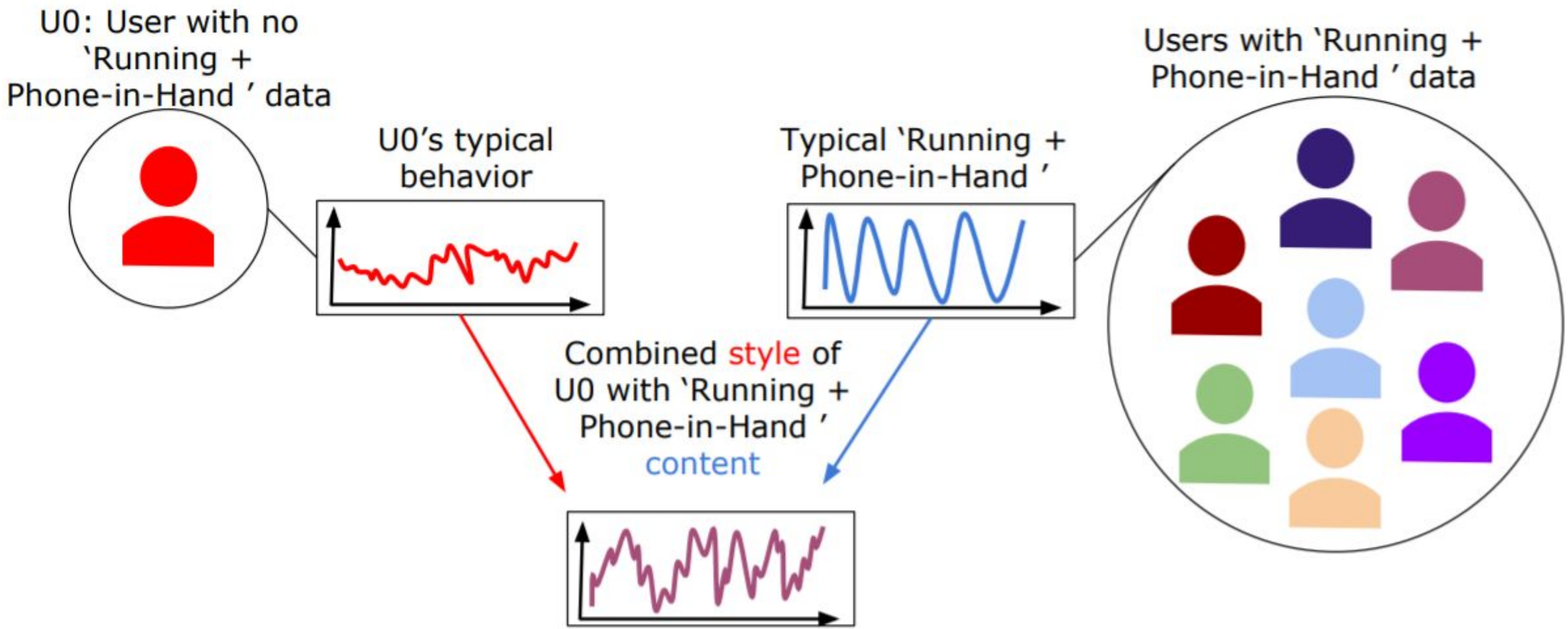


We do not have data for every context data for every user

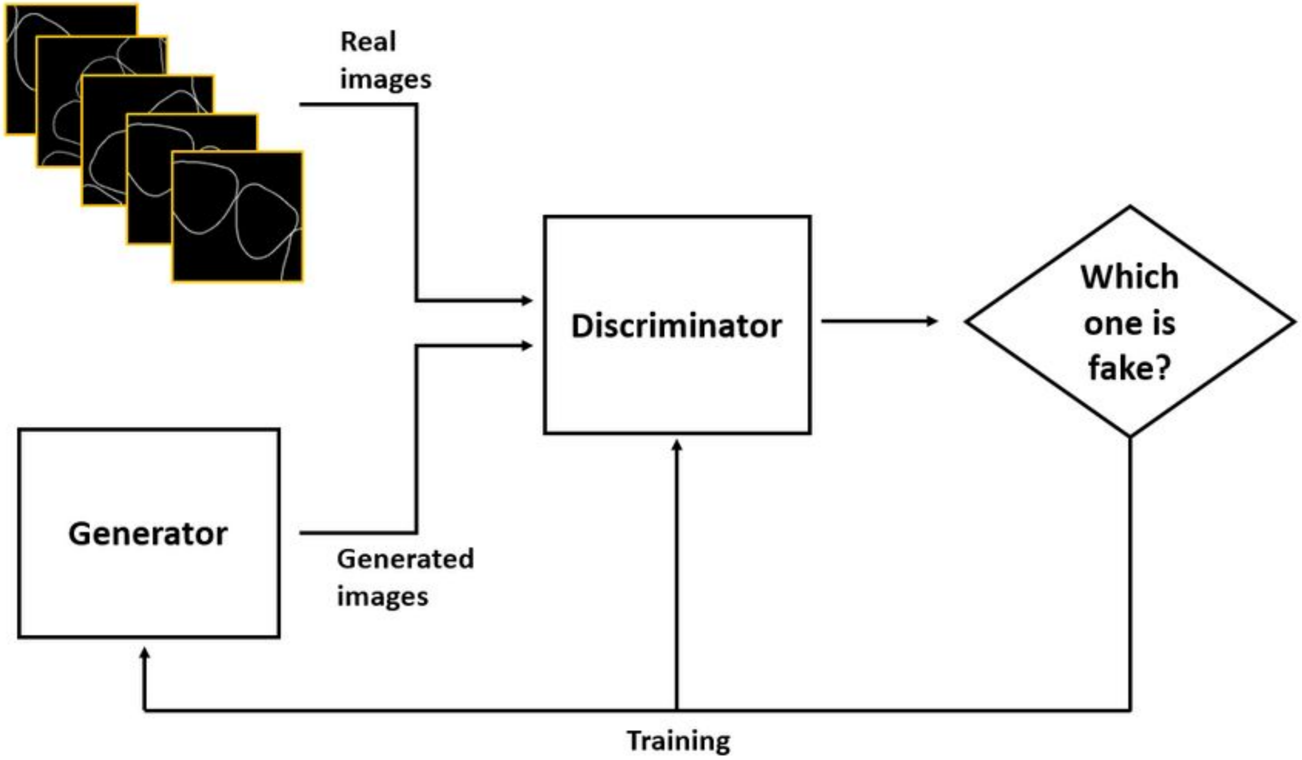
Missing User-Context Pairs



Idea: Generate Characteristic Data



Approach: Generative Adversarial Network (GAN)



 [1]

Simple GANs

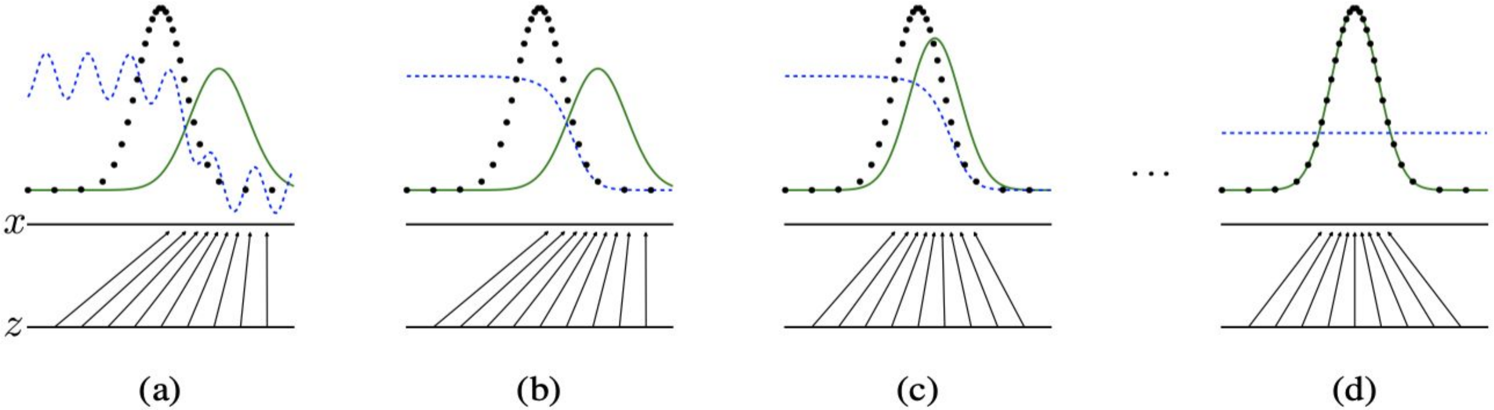
- ***G*** learns a transformation *f(z)* = *x* such that all generated *x* converge towards the corpus.
- ***D*** should no longer be able to discern between ***G***'s distribution and the corpus.

Legend:

Discriminative distribution: – –

Generative distribution: —

Corpus distribution: · · ·



 [2]

Conditional GANs

- Forces ***G*** to generate with a specific class/feature
- Reduces class imbalance during ***G***'s training

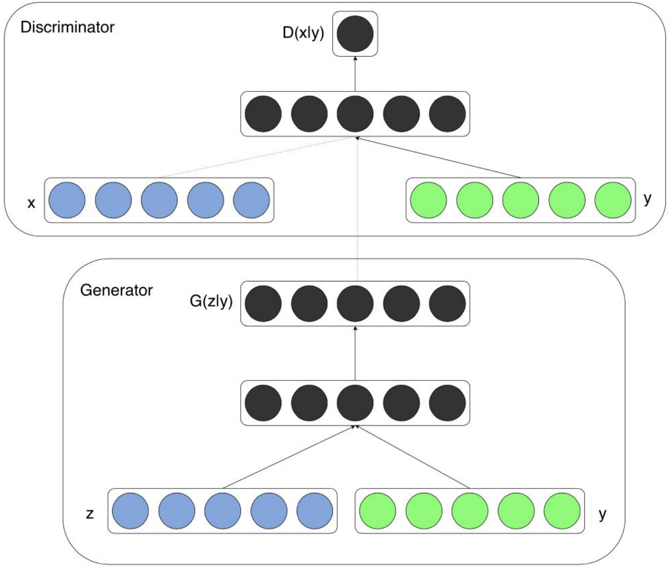
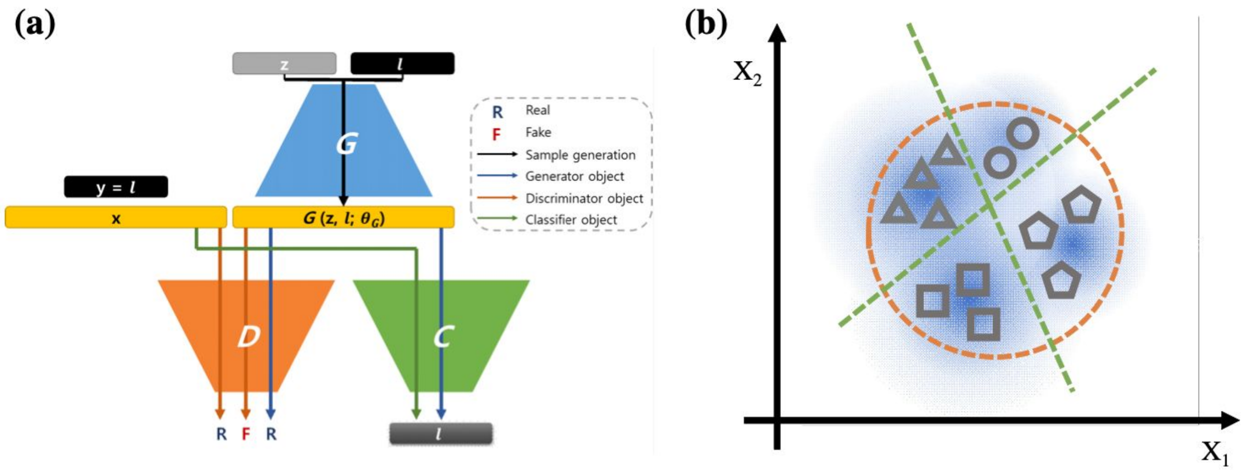


Figure 2: Generated MNIST digits, each row conditioned on one label

 [3]

Controllable GANs

- Addition of third machine, classifier
- Alters discrete features



Legend:

Classifier ***C***:

Discriminator ***D***:

Grey figures: corpus samples from different classes

Generator: blue region

 [4]

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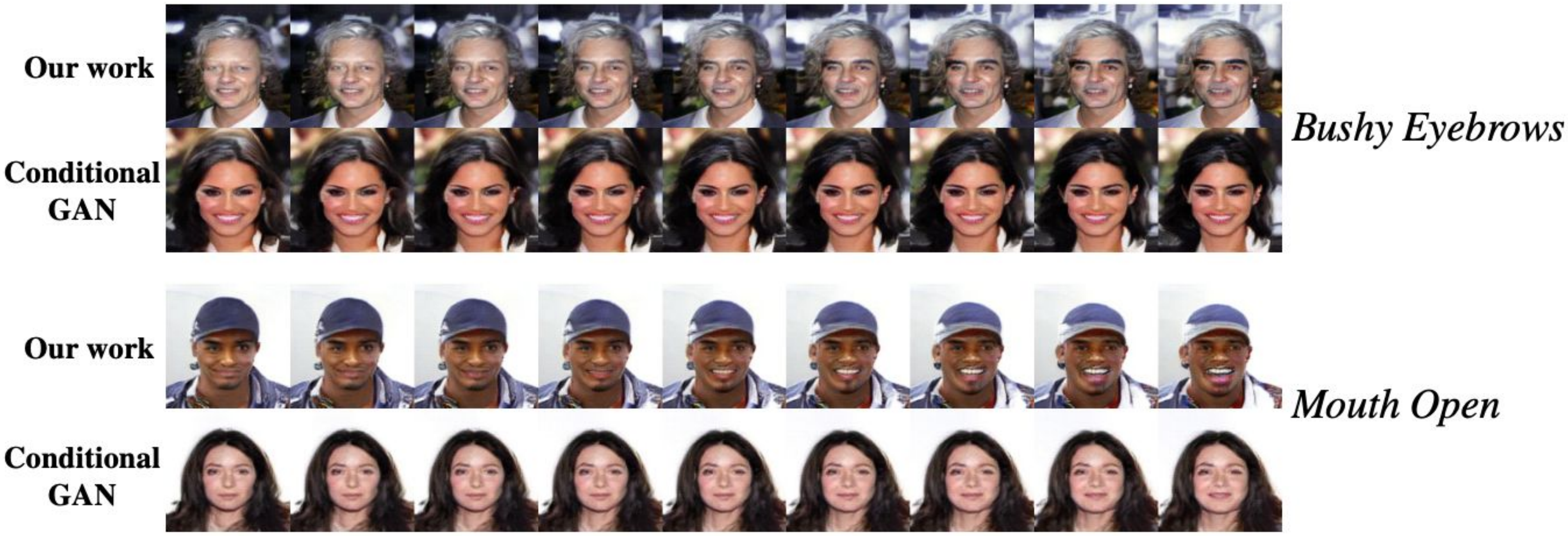
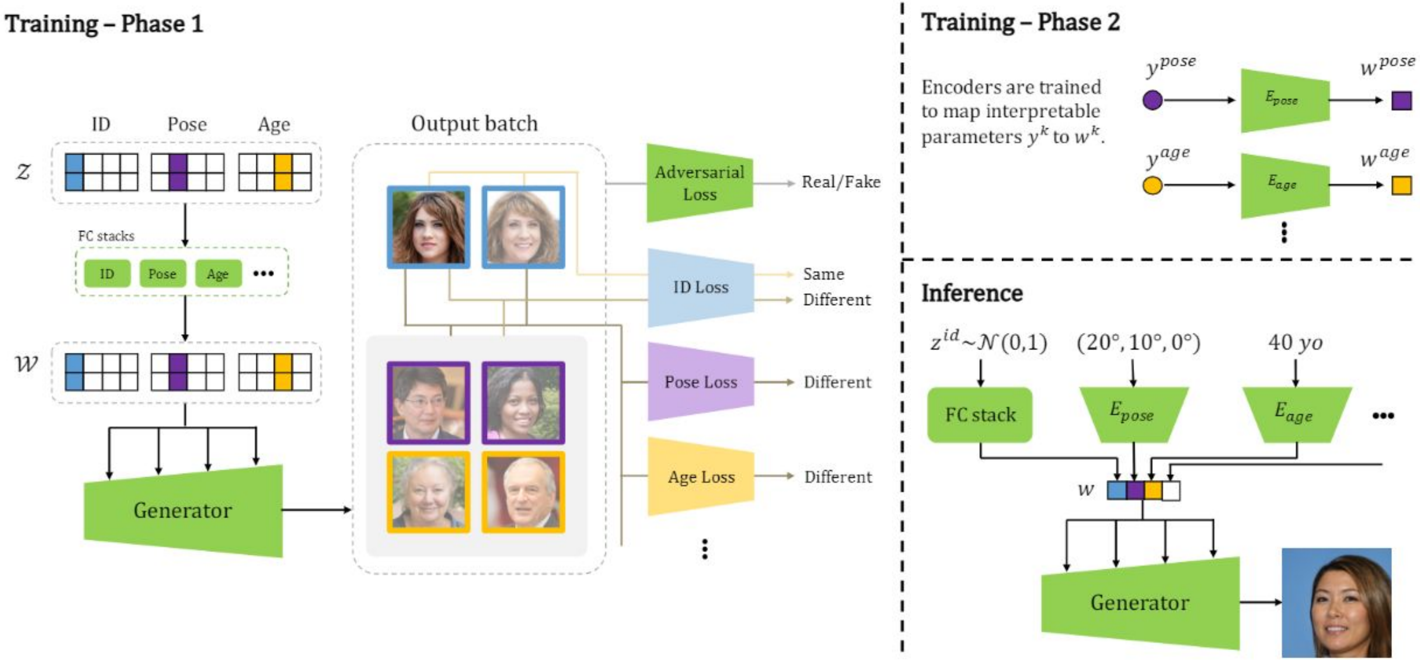


 [4]

Explicitly Controllable GANs

- Standard generator/discriminator models
- Alters a set of independent, continuous features



 [5]

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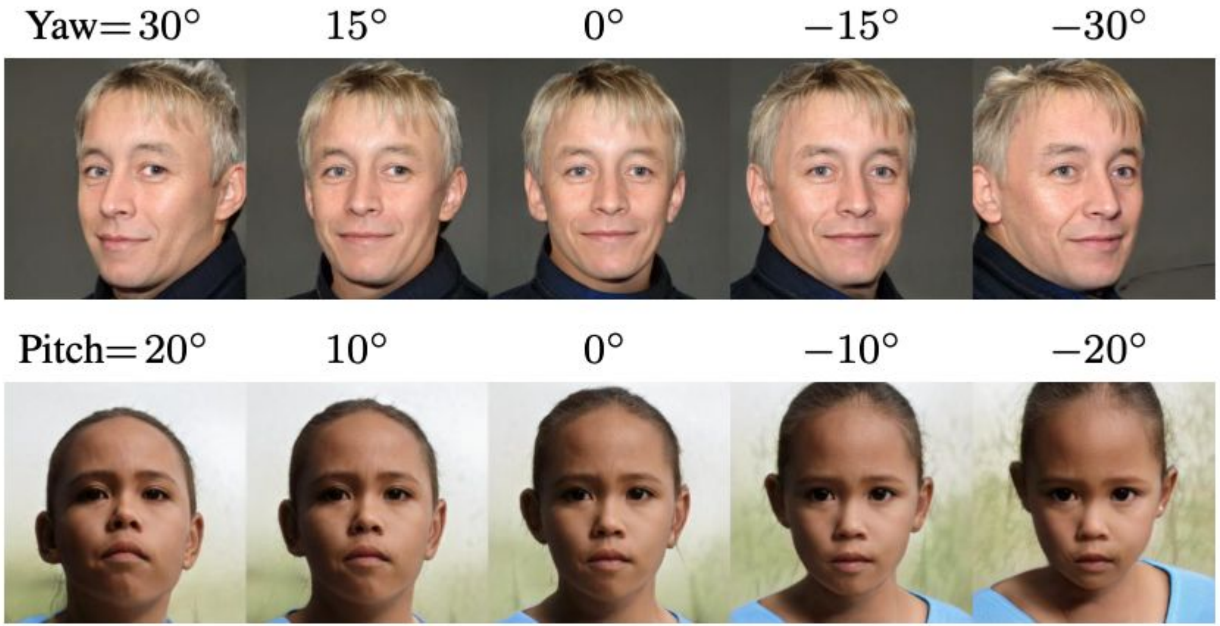

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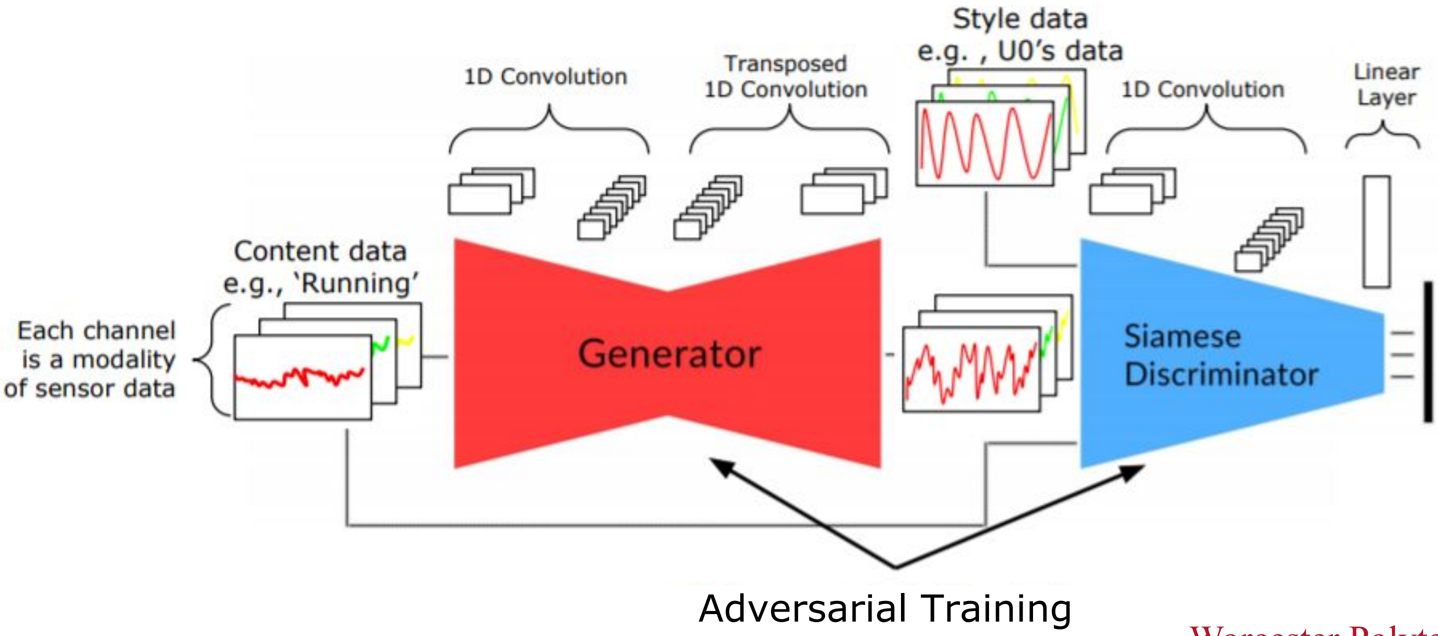
Implementation for Mobile Sensor Data

- Smartphone data: 1D sequences with N channels
  - Channel: modality/sensor
- Generator: 1D convolution + transposed 1D convolution
  - Discriminator: 1D convolution + Linear



Completed Coding Tutorials

jupyter

PyTorch

ANACONDA®

scikit learn

References

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[2] I. J. Goodfellow et al., “Generative adversarial nets,” in Proceedings of the 27th International Conference on Neural Information Processing Systems - Volume 2, Cambridge, MA, USA, Dec. 2014, pp. 2672–2680.

[3] M. Mirza and S. Osindero, “Conditional Generative Adversarial Nets,” ArXiv14111784 Cs Stat, Nov. 2014, Accessed: May 27, 2021. [Online]. Available: http://arxiv.org/abs/1411.1784

[4] M. Lee and J. Seok, “Controllable Generative Adversarial Network,” ArXiv170800598 Cs Stat, Mar. 2019, Accessed: May 27, 2021. [Online]. Available: http://arxiv.org/abs/1708.00598

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