DeepFakes — Production & Detection using Deep Learning Methodologies.

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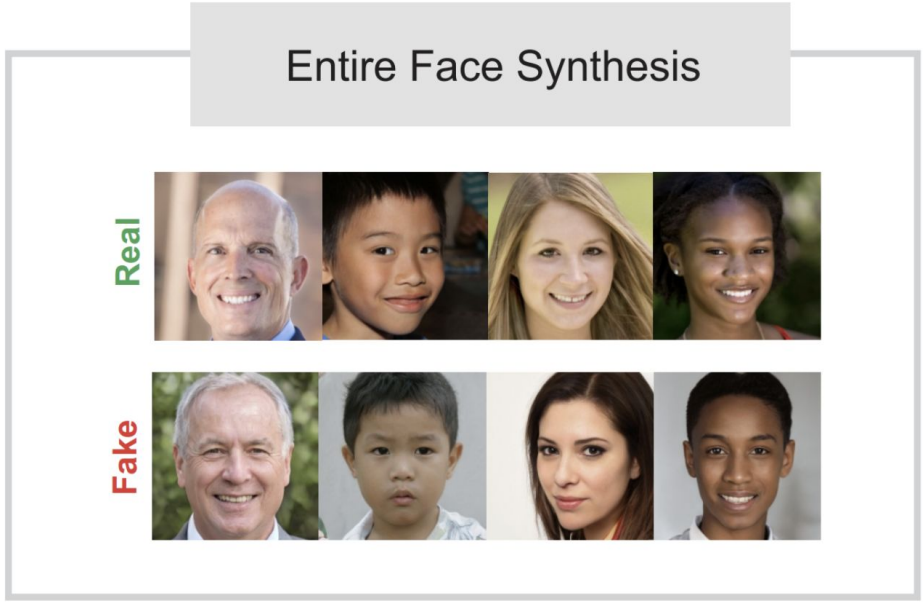
Types of Manipulations

1. **Entire Face Swap**
2. **Identity Swap**
3. **Attribute Manipulation**
4. **Expression Swap**

Entire Face Swap

Happens when the entire face of a person is swapped with another person. We can visualize it in the example below:-



Things to note:-

1. The other physical features of a person remains the same
2. Entire face is swapped
3. Can be used in **movies**, **memes**, **fun videos**, **educational purpose**
4. Can also be used in **spreading hoax**, **pornographic content**, **mis-identification** etc.

Entire Face Swap

TECHNOLOGIES USED TO GENERATE

1. StyleGAN
2. ProGAN
3. GANPrintR

(a) Fake (b) Fake after GANprintR

Fake image created by StyleGAN and its an improved version using GANprintR.

DETECTION METHOD

1. SVM
2. k-NN
3. k-NN, SVM, LDA
4. CNN + Incremental Learning
5. CNN + Attention Mechanism
6. CNN + AE

Identity Swap

Identity swap technically swaps the face of an individual with the face of someone else.
It’s depicted by the image below:-

An example of Identity Swap

Identity Swap

TECHNOLOGIES USED TO GENERATE

1. CycleGAN
2. Gauss-Newton optimization
3. Multi-Task CNN

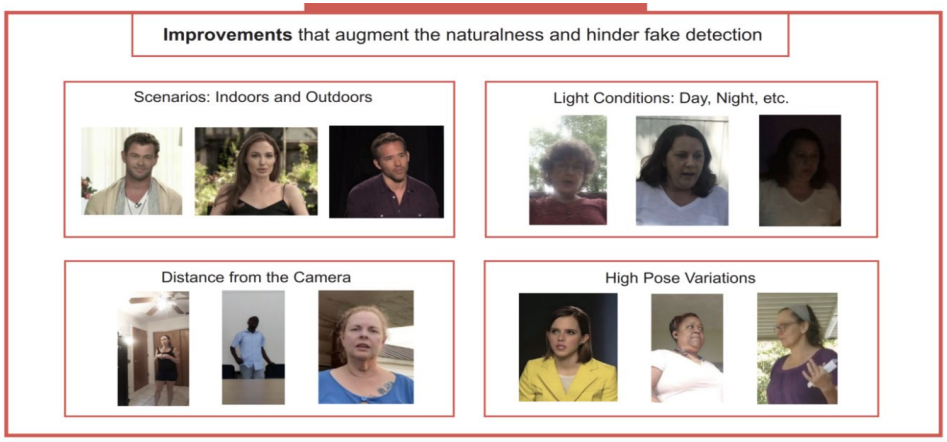


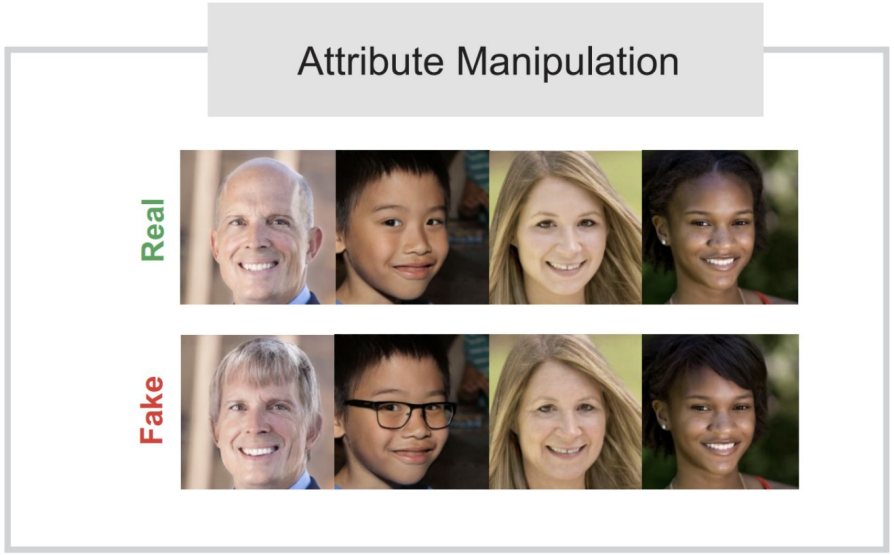
Image generated from 2nd generation Identity Swap

DETECTION METHOD

1. Mel Frequency Cepstral Coefficients(MFCCs)
2. 3-D Head Poses
3. Deep Vision
4. Fast-Hyper-Face
5. Eye-Aspect-Ratio

Attribute Manipulation

Attribute Manipulation has played a major role in the fashion and marketing industry. This process helps in manipulating various physical facial features to make them better or worse. We can visualize it in the example below:-



An example of Attribute Manipulation

Attribute Manipulation

TECHNOLOGIES USED TO GENERATE

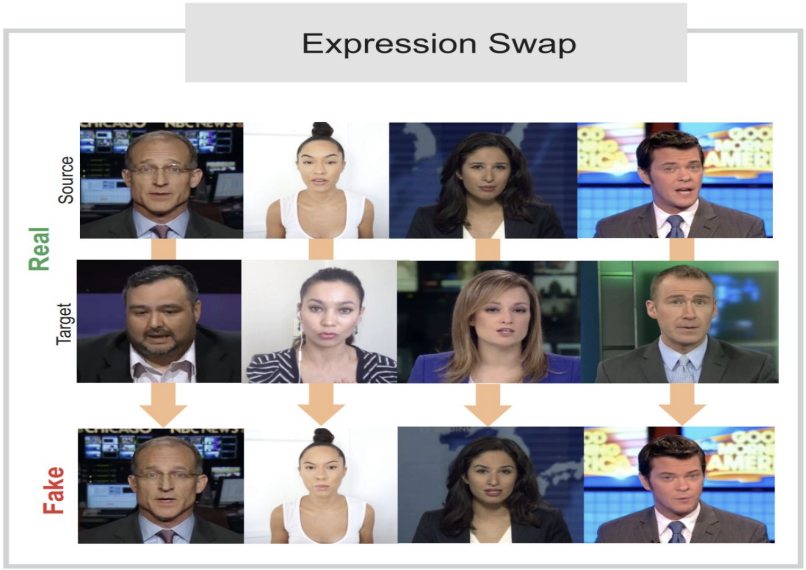
1. Invertible Conditional GAN(IcGAN)
2. StarGAN
3. AttrGAN
4. STGAN

DETECTION METHOD

1. RBM(Restricted Boltzmann Machine)
2. CNN and a combination of pixels
3. Analysis of internal GAN pipeline
4. Deep learning methods along with SVM
5. GAN Discriminator
6. Core-Level Fusion
7. CNN + Incremental Learning
8. CNN + Attention Mechanism

Expression Swap

This technique can be used to manipulate or add the facial expression of one person to another. One can see various expressions that are exchanged and utilized for various purposes.We can visualize it in the example below:-



An example of Expression Swap

Expression Swap

TECHNOLOGIES USED TO GENERATE

1. NeuralTextures
2. StarGAN
3. InterFaceGAN
4. STGAN
5. AttGAN

DETECTION METHOD

1. 3DCNN
2. I3D
3. 3DResNet
4. CNN + RNN
5. CNN + Attention Mechanism
6. CNN + Optical Flow