VIMAL

VISUAL INTELLIGENCE AND MULTIMEDIA ANALYTICS LABORATORY

FAKE VISUAL EVIDENCE

CREATION, DETECTION AND ADMISSIBILITY

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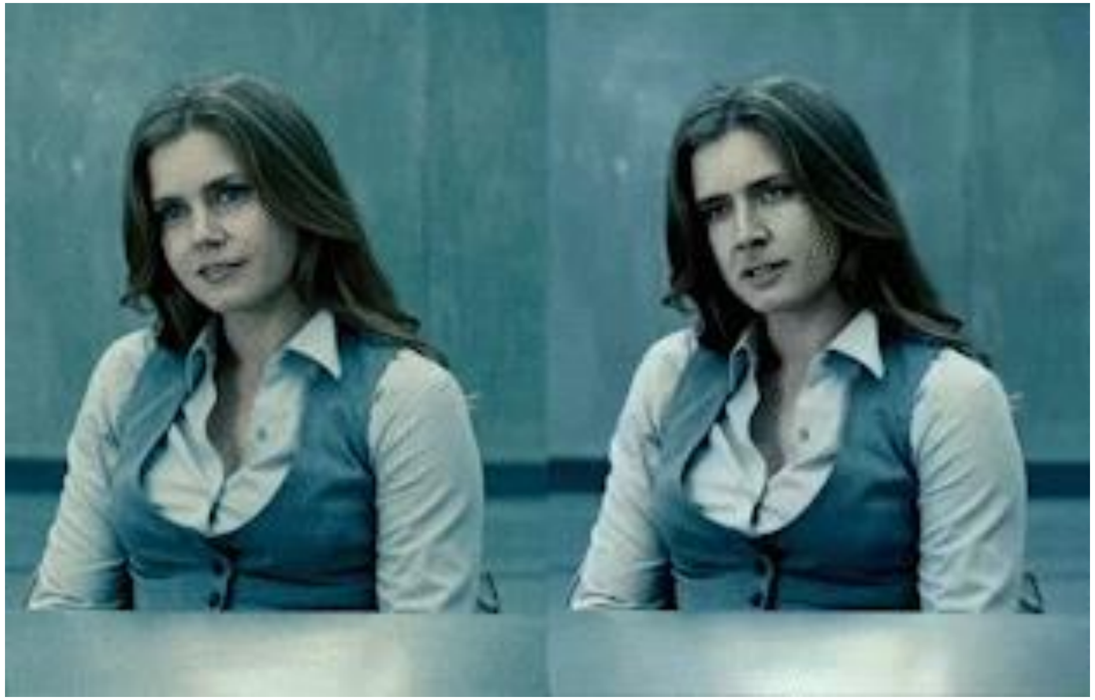
WHAT ARE DEEPFAKES?

DEEPFAKES

Fake video of a target person (i.e. victim) created using ***deep*** neural network



HOW LONG DID DEEPFAKES EXIST?

- Forever
- Paul Walker in Fast & Furious 7 replacement cost $50M

SO WHAT IS THE BIG DEAL?

ARTIFICIAL INTELLIGENCE (AI)

DEMOCRATIZATION OF AI

- Accessible
- Sharable

SOCIAL NETWORKS

- Echo chambers
- Confirmation bias

DEEPFAKE TYPES

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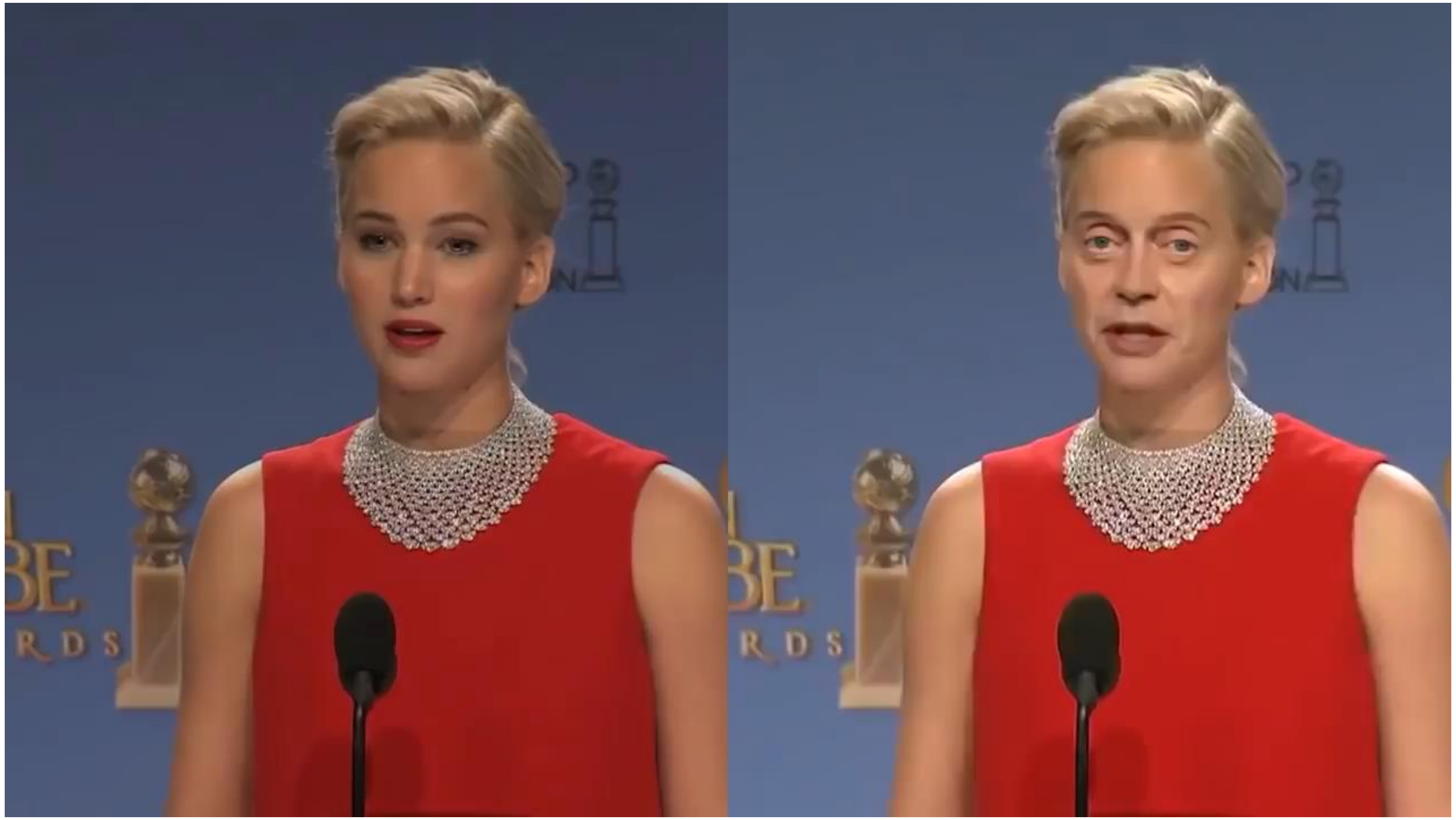
FACE REPLACEMENT



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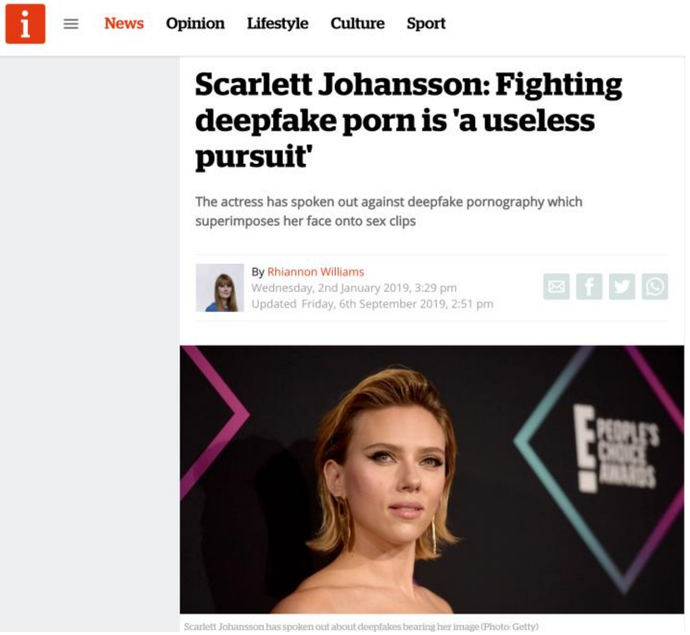
FACE REENACTMENT

DANGERS OF DEEPFAKES

LEGAL IMPLICATIONS

Jeremy Corbyn backing Boris Johnson

National security



Scarlett Johansson: Fighting deepfake porn is 'a useless pursuit'

The actress has spoken out against deepfake pornography which superimposes her face onto sex clips

By Rhiannon Williams
Wednesday, 2nd January 2019, 3:29 pm
Updated Friday, 6th September 2019, 2:51 pm

Scarlett Johansson has spoken out about deepfakes bearing her image (Photo: Getty)

Revenge porn

- Public relations
- Child exploitation
- Stock market
- Court room evidence
- Insurance fraud

STATISTICS

- **14,678** deepfake videos online
- **96%** of which were pornographic in nature
- **100%** featured women
- **134,364,438** views
- **Doubles** every **six** months

* The State Of The Deepfakes, Deeptrace, September 2019

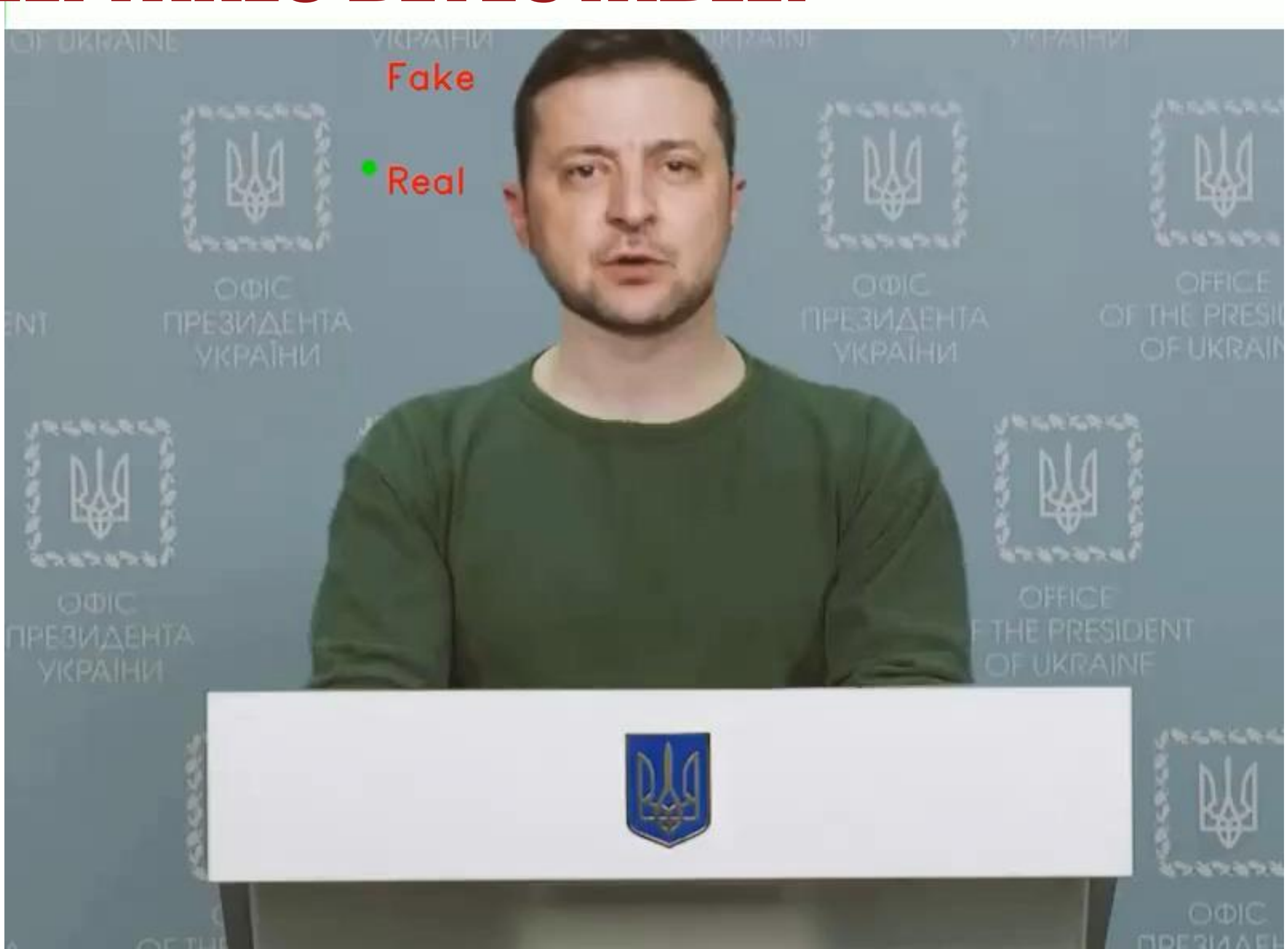
IDENTIFYING DEEPFAKES

ARE DEEPFAKES DETECTABLE?

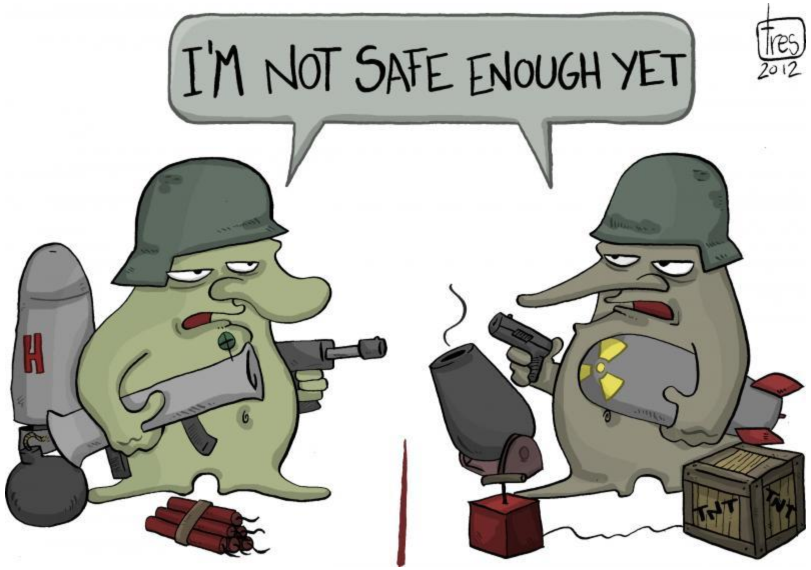
CSU
The times when we could completely count on others, they are over to a certain extent.

ARE DEEPFAKES DETECTABLE?

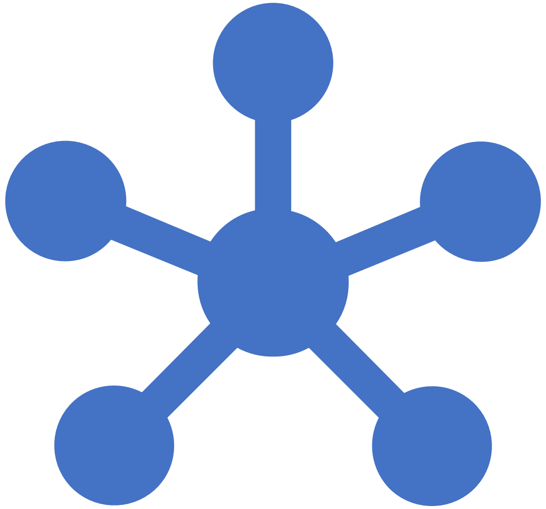
ARE DEEPFAKES DETECTABLE?



CHALLENGES



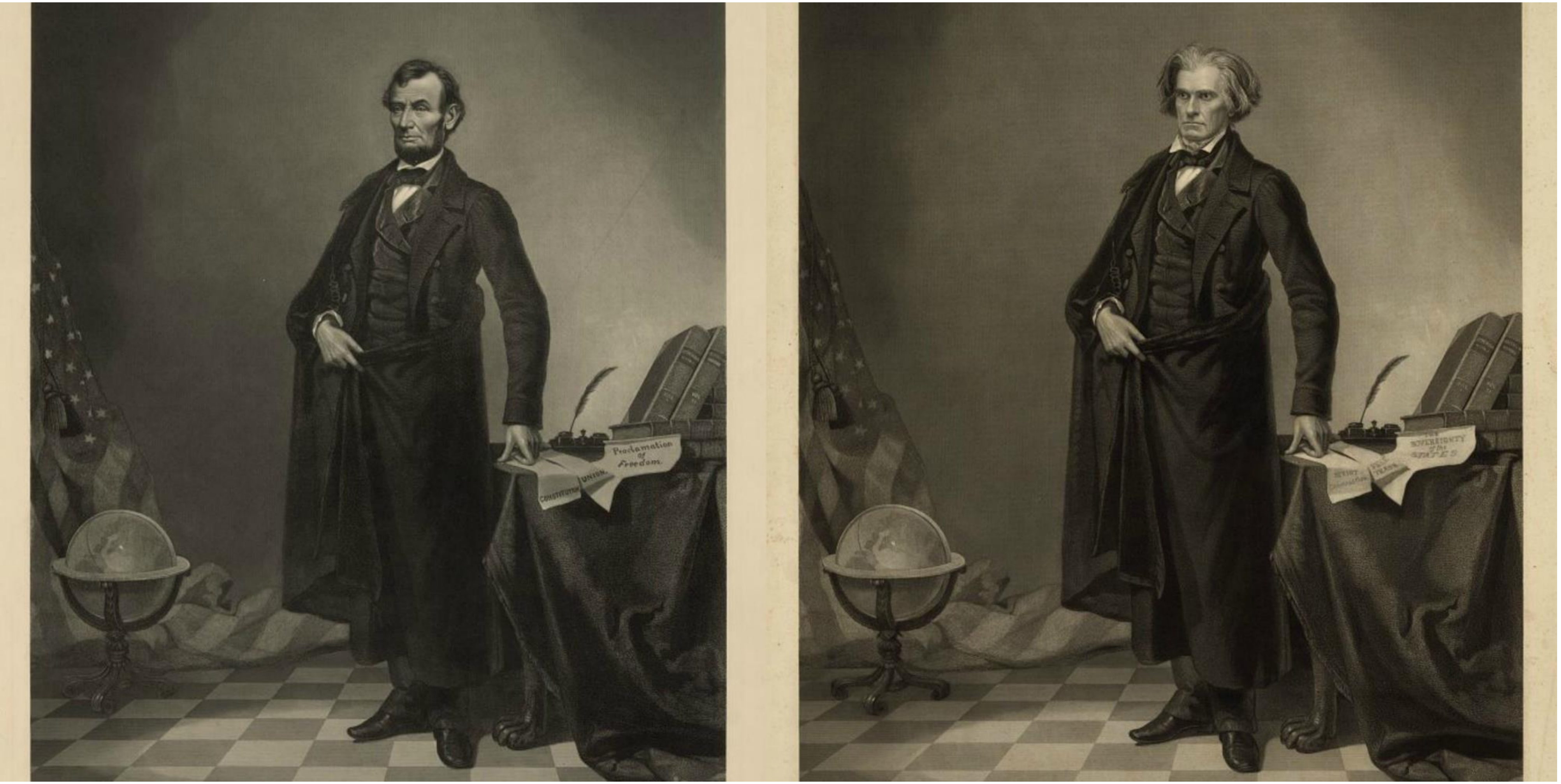
Detecting new deepfake generation methods



Social networks

IMAGE MANIPULATION

WHAT IS IMAGE MANIPULATION?



OBJECTIVE

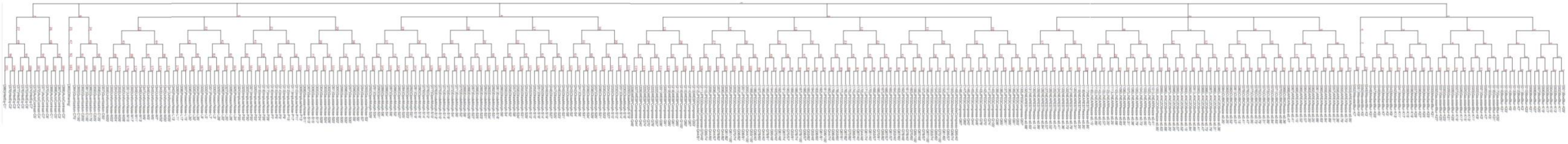
- Works across wide range of manipulations
  - At different granularities
- Capable of localizing manipulations
  - Can be used as forensics evidence
- Performs well on different evaluation datasets
- Does not need fine tuning
- Robust against anti-forensic techniques

BASIC MANIPULATION FAMILIES

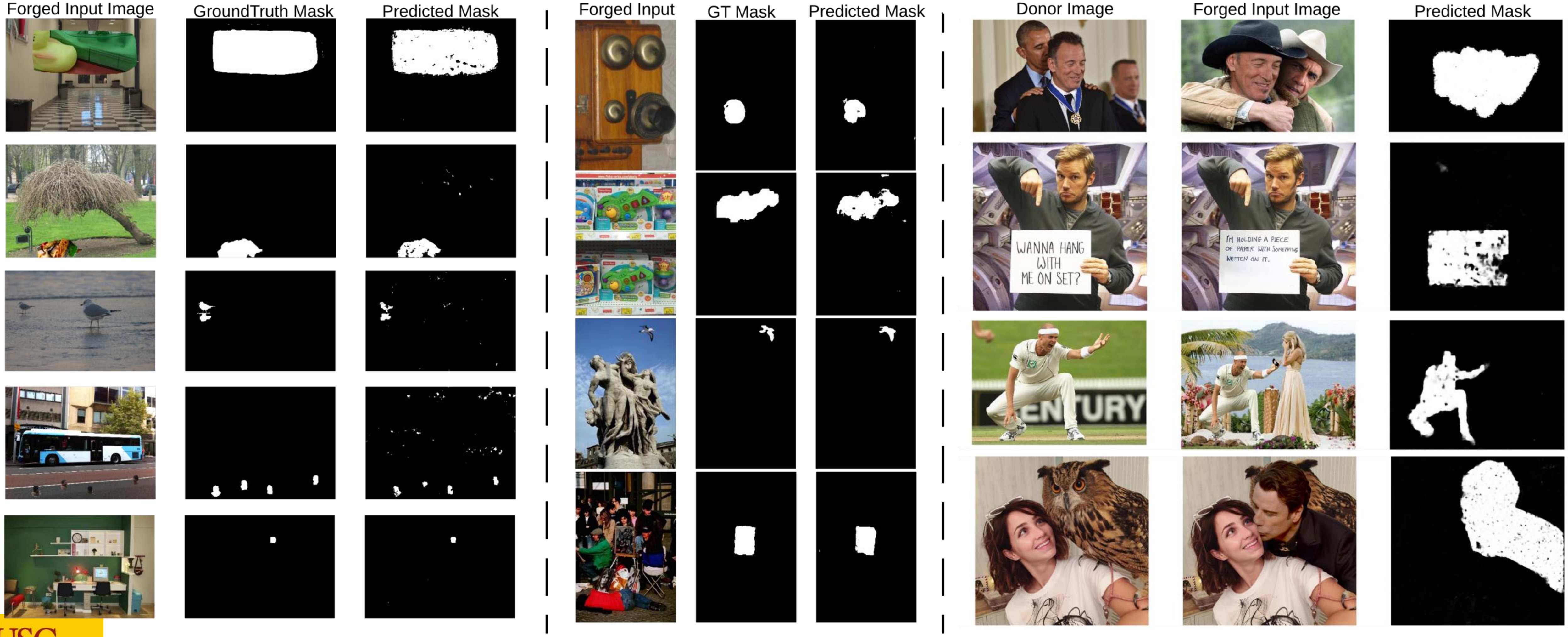
- Compression (JPEG, WebP, …)
- Blurring (Gaussian, media, wavelet, …)
- Morphology (Dilation, erosion, …)
- Contrast manipulation (Histogram equalization, Auto contrast, …)
- Additive noise (Poisson, Gaussian, …)
- Resampling (Lancoz, linear, …)
- Quantization

MANIPULATION HIERARCHY

- Fine-grained manipulations
- Six-level hierarchy
- 385 manipulations
- Dresden Image Database for creating training dataset
- Kaggle Camera Model Identification for testing



QUALITATIVE RESULTS



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ADMISSIBILITY OF MANIPULATION DETECTION EVIDENCE

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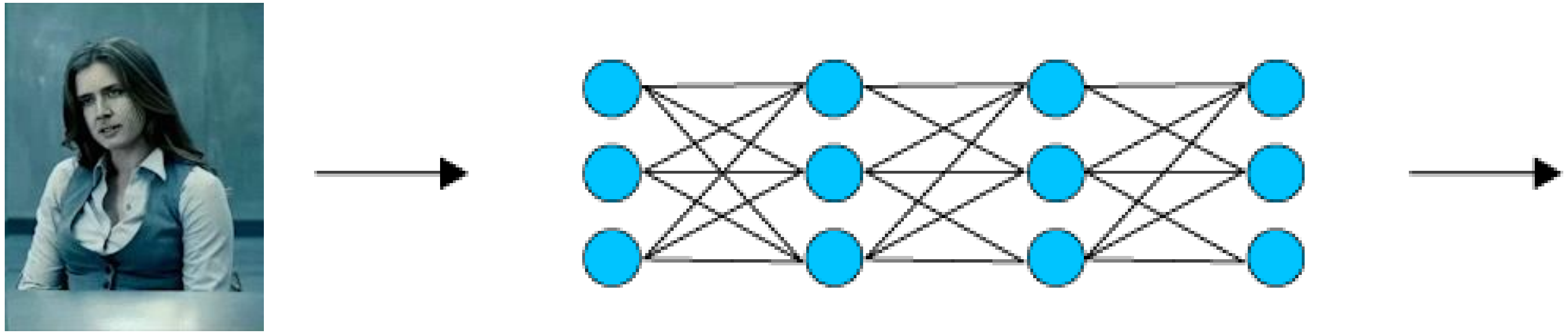
ADMISSIBILITY OF SCIENTIFIC EVIDENCE

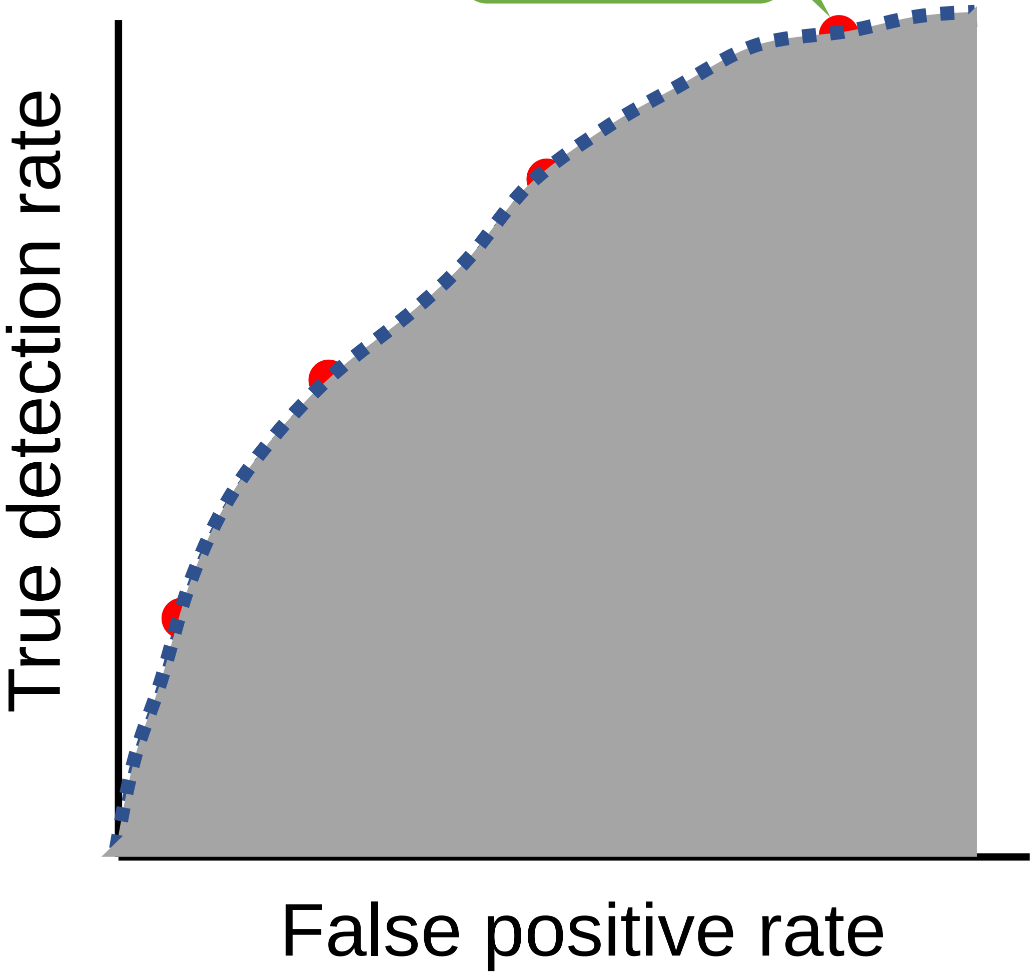
- ***Frye*** standard (general acceptance test)
  - Expert opinion based on a scientific technique is admissible only when the technique is generally accepted as reliable in the relevant scientific community
- ***Daubert*** standard
  - *A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:*
    - *(a) The expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;*
    - *(b) The testimony is based on sufficient facts or data;*
    - *(c) The testimony is the product of reliable principles and methods; and*
    - *(d) The expert has reliably applied the principles and methods to the facts of the case.*

HOW DO DETECTION ALGORITHMS WORK?



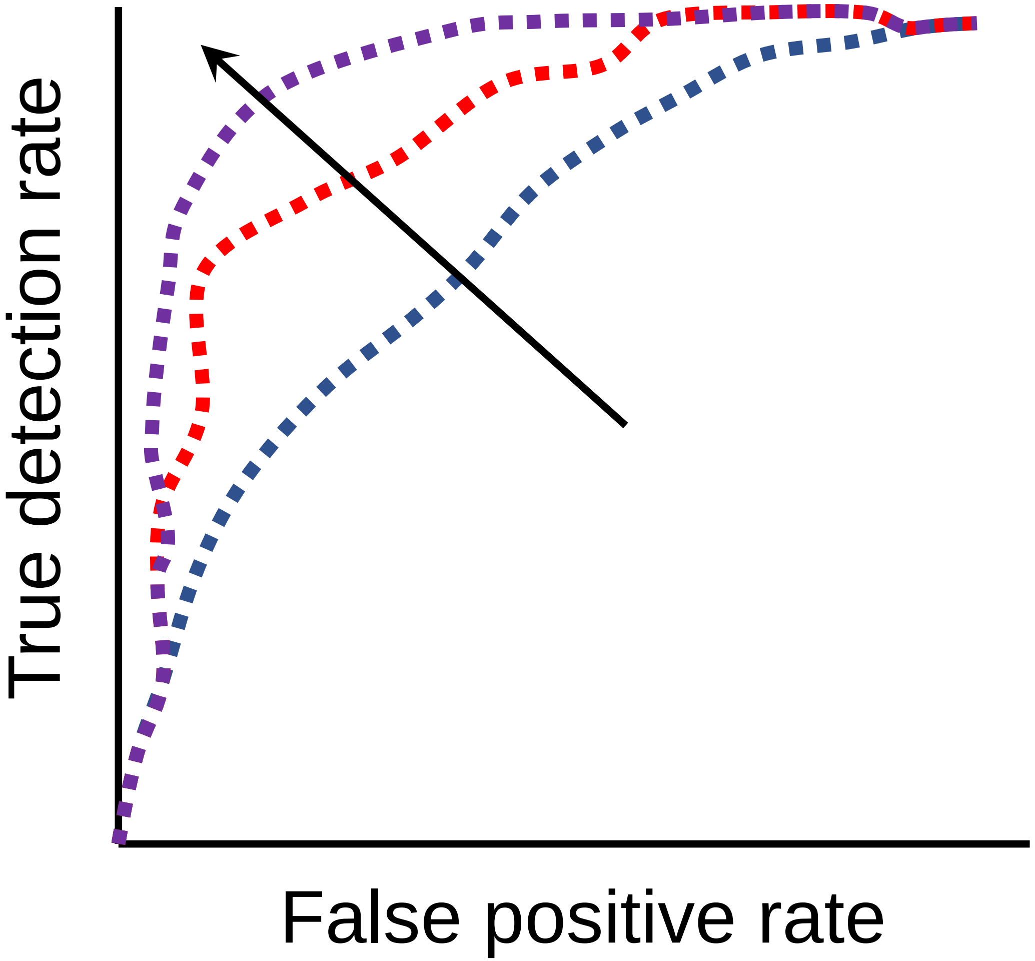
real or fake?
0 – 1

HOW DO DETECTION ALGORITHMS WORK?



Performance at another decision threshold

HOW DO DETECTION ALGORITHMS WORK?



FINAL THOUGHTS

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isn't
SEEING IS
BELIEVING

THANK YOU