Deepfake Call Detection: Mitigating Next-Gen Social Engineering

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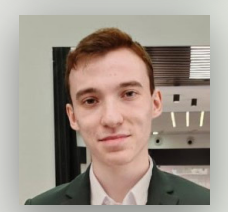
Offensive AI Research Lab

Principal Investigator

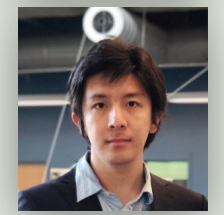










https://offensive-ai-lab.github.io/

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Agenda

- Background & Motivation
- Existing Defenses
- Our solution - Deepfake-CAPTCHA
- Usability Demo

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Background & Motivation

- Deep-Fake (DF)
- Real-Time Deep-Fakes (RT-DFs)

What is Deep-Fake (DF)

“Any believable media generated by a deep neural network”

A decade of DF improvements

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Two Deep-Fake Types

Video

Samsung’s MegaPortrait Generates Deepfake Videos from Still Images

Audio

Respeeecher Demo May 2022

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Video Deepfake

Can be used for art

The Heart Part 5
by Kendrick Lamar

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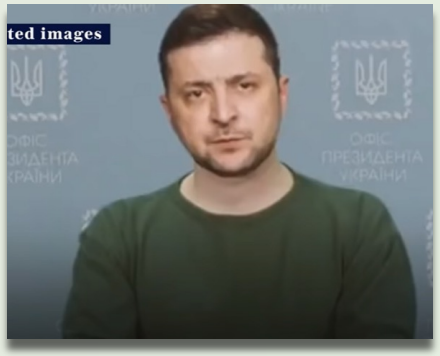
Why Should We **Care**?

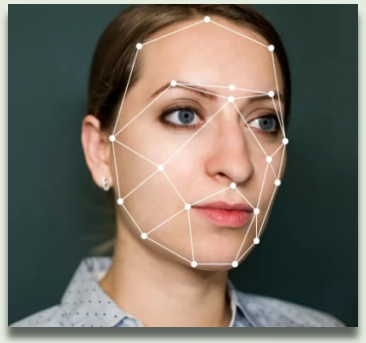
Deepfake abuse examples

Malicious Goals:

- Blackmail
- Abuse
- Misinformation
- Scams
- Media Tampering
- Fake Porn



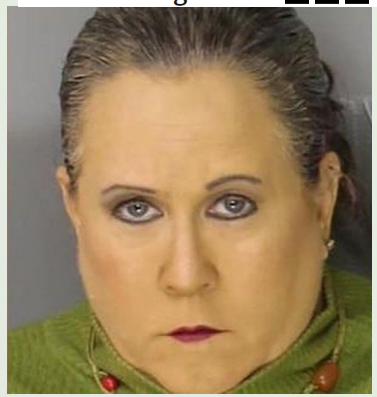
https://www.wired.com/story/zelensky-deepfake-facebook-twitter-playbook/



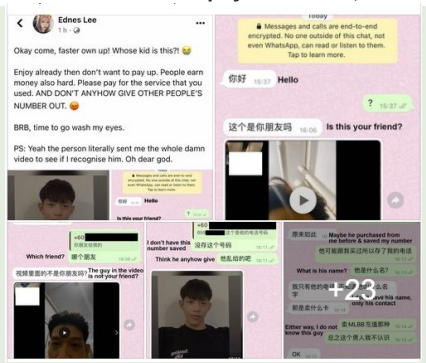
https://www.technologyreview.com/2021/02/12/1018222/deepfake-revenge-porn-coming-ban/

https://www.motherjones.com/politics/2019/03/deepfake-gabon-ali-bongo/

Mother 'used deepfake to frame cheerleading rivals' BBC



Singaporean man's face ends up in deepfake porn after he refuses to pay hacker $5,800 yahoo!news



https://www.businessinsider.com/video-boris-johnson-endorses-jeremy-corbyn-in-convincing-deepfake-2019-11

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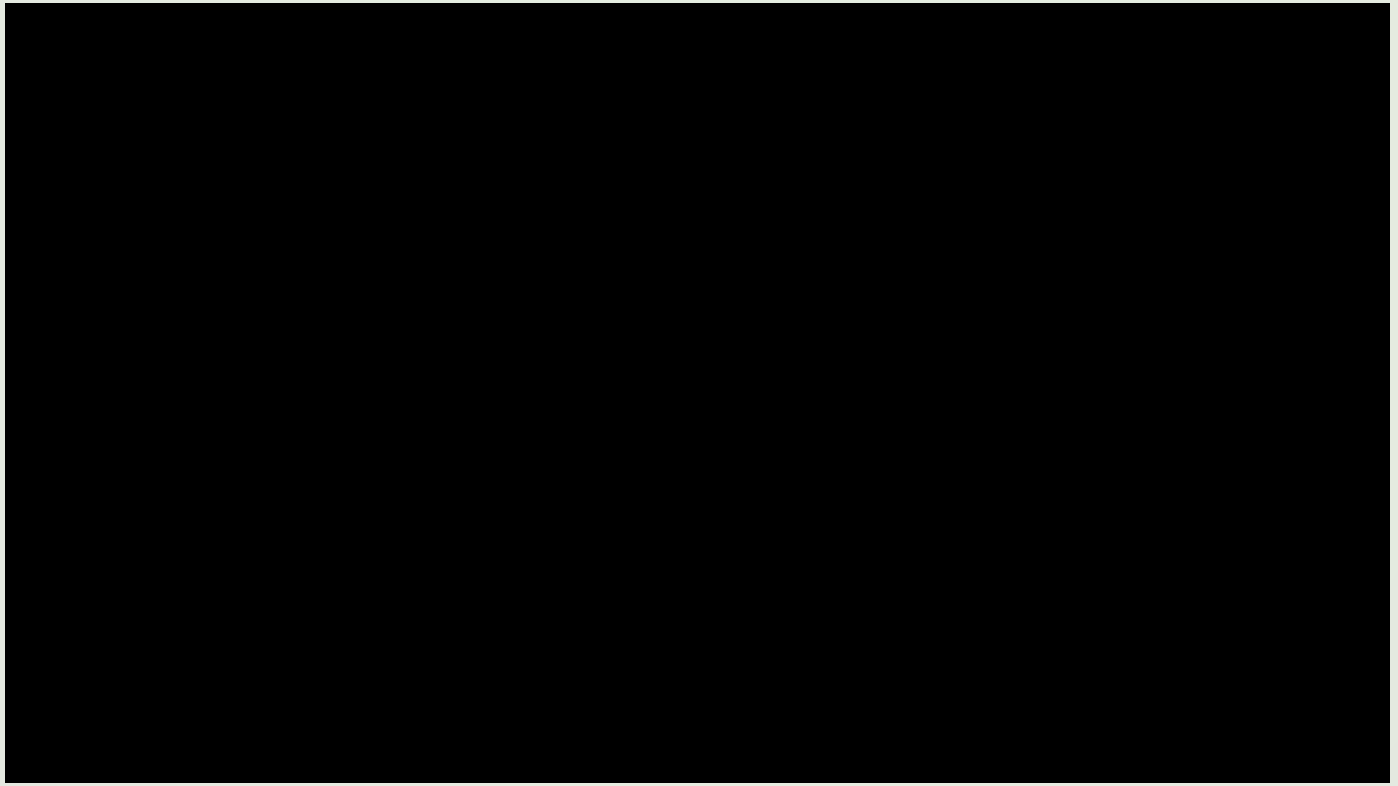
Why Should We **Care**?

Combining Video and Audio Deepfake - dangerous



Boris Johnson claims that his opponent is more suitable

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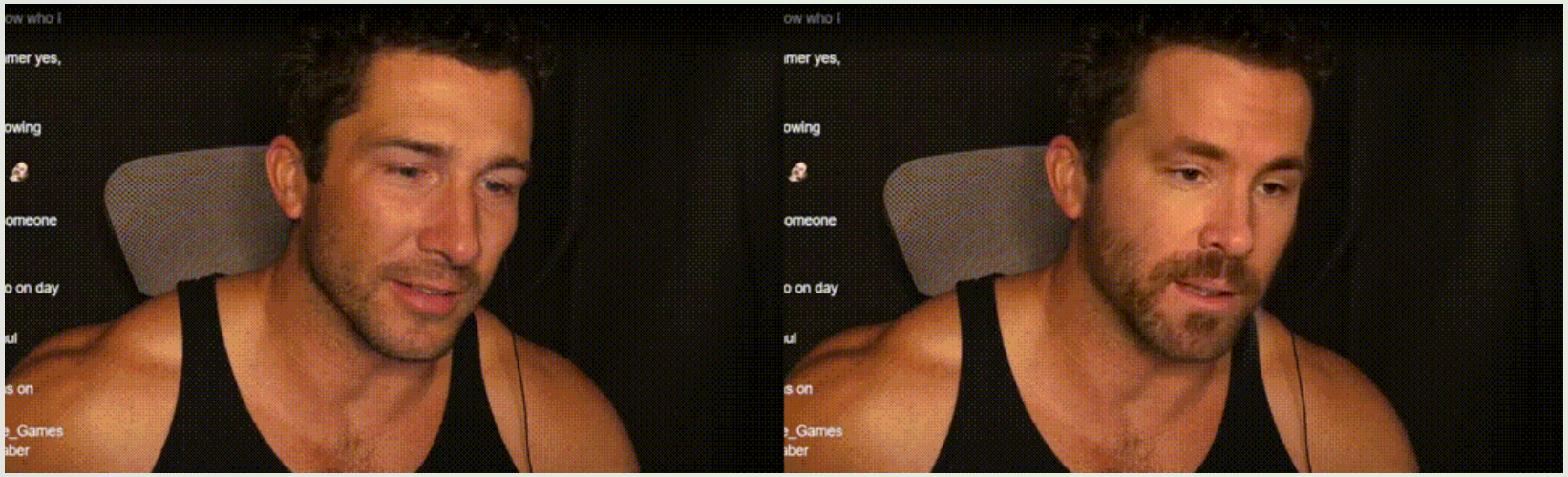
Real-Time Deep-Fakes - An Emerging Threat

- Minimal **delay** which allows **interactive discussions**
- RT-DF enable to preform **Social engineering** attacks in two aspects:
  - **Psychology** - People confuse familiarity with authenticity
  - **Awareness** - RT-DFs are an unexpected attack vector

Forbes

Fraudsters Cloned Company Director's Voice In $35 Million Bank Heist, Police Find



DeepFaceLab – open source real-time deepfake software

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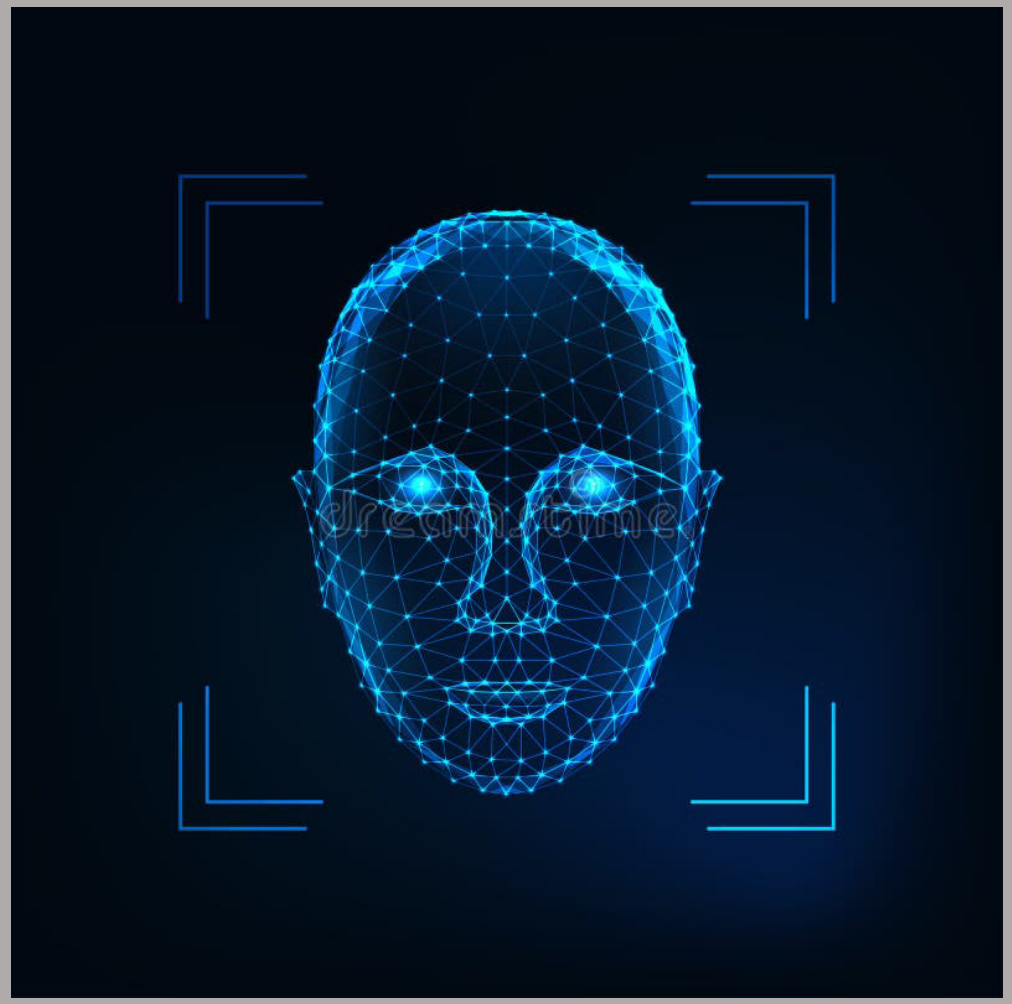
Existing Defenses

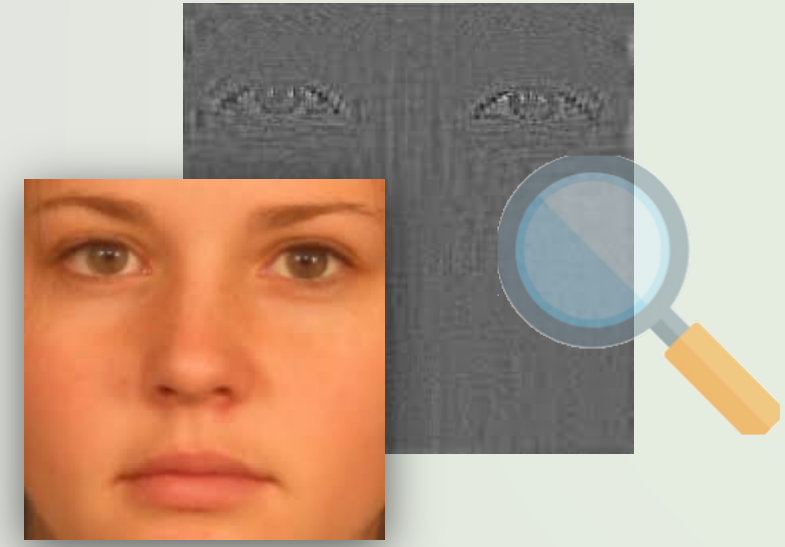
- Common Approaches
- Limitation



Existing DF Defenses

Common Approaches

1. **Analytical**



signal extraction

2. **Directed**
(*Artifact-Specific)*

ML focused on specific features

3. **Undirected**
   - Classifiers
   - Anomaly Detectors

ML given all features
(learns own features)

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The **Problem** with Current Defenses

When it comes to detecting RT-DFs…

Practically

- Defenses must be efficient
- No reference data

Delivery

- Defenses must be flexible
- Expect specific types of artifacts/DF-pipelines

Quality

- Defenses must be robust: dealing with noise and compression
- Noise and compression decrease performance

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Current Defenses Summary

- **Passive defenses -** Artifacts are expected in deepfake
- Quality of deepfake is **rapidly improving**
- Argument: Seeking out existing artifacts is a **losing game**

Our solution - Deepfake-CAPTCHA

- Deepfake-CAPTCHA system
- Evaluation

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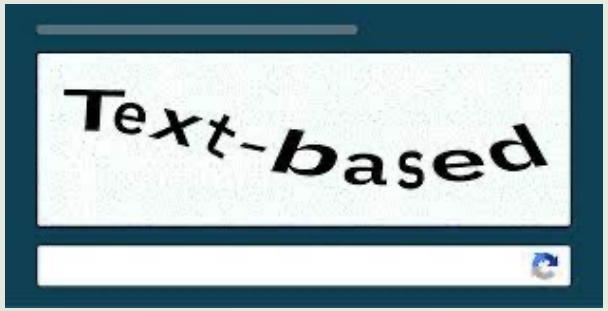
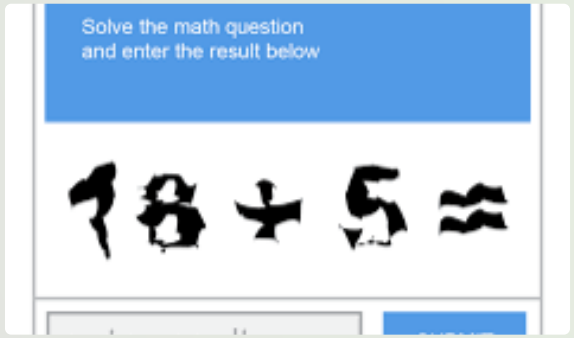
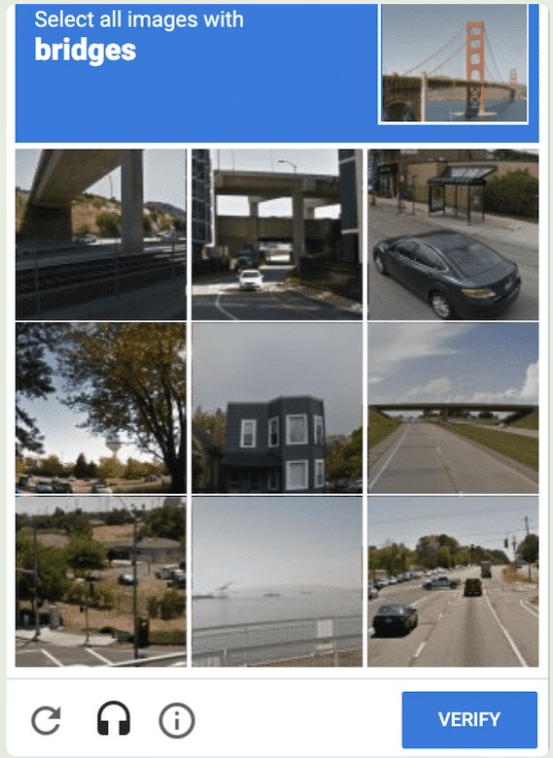
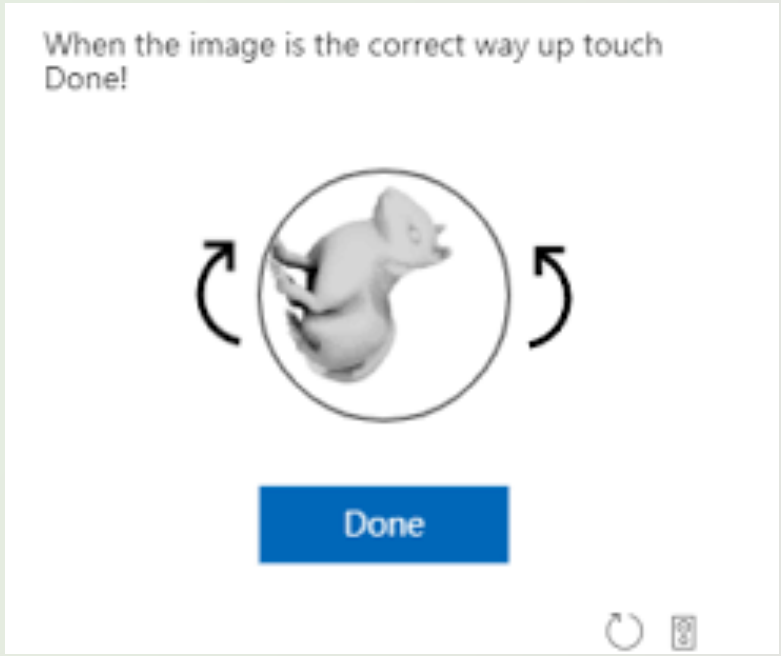
CAPTCHA - An Active Defense

"A cryptographic protocol whose underlying hardness assumption is based on an AI problem."
CAPTCHA: Using Hard AI Problems for Security, Luis von Ahn et. al









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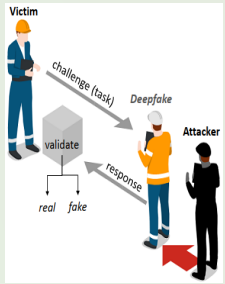
Our solution - Deepfake-CAPTCHA

The Framework:



Challenge the caller to create content:

1. Victim/server sends a challenge
2. Caller responds
3. Verification of challenge

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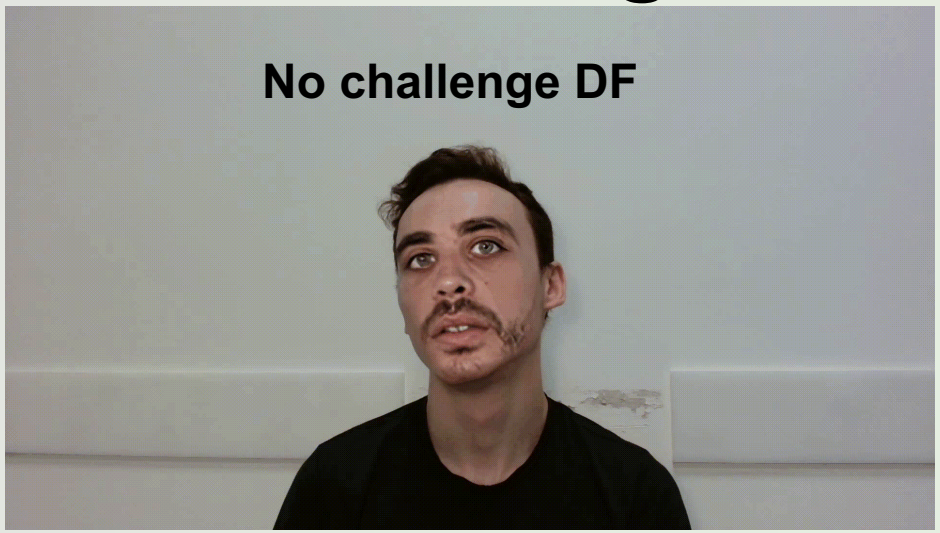
Video Challenge Example



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Audio Challenge Example

Real Audio

Fake Audio

Fake challenge – Clapping

Fake challenge – Playback

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The Challenge Purpose

Forces creating content with the following constraints:

Realism

Identity

Task

Time

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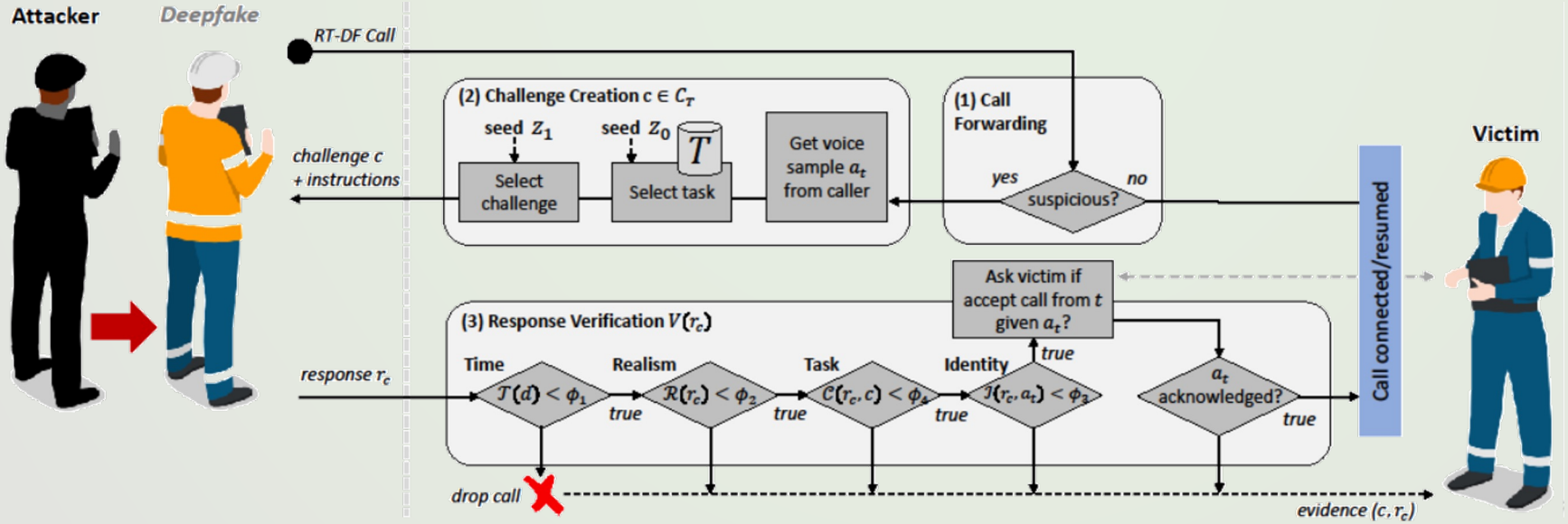
DF Detector Components

- **Realism Verification *(R)*** - Anomaly detector
- **Identity Verification *(I)*** – Speaker recognition
- **Task Verification *(C)*** – Task classifier
- **Time Verification *(T)*** - Time constraint



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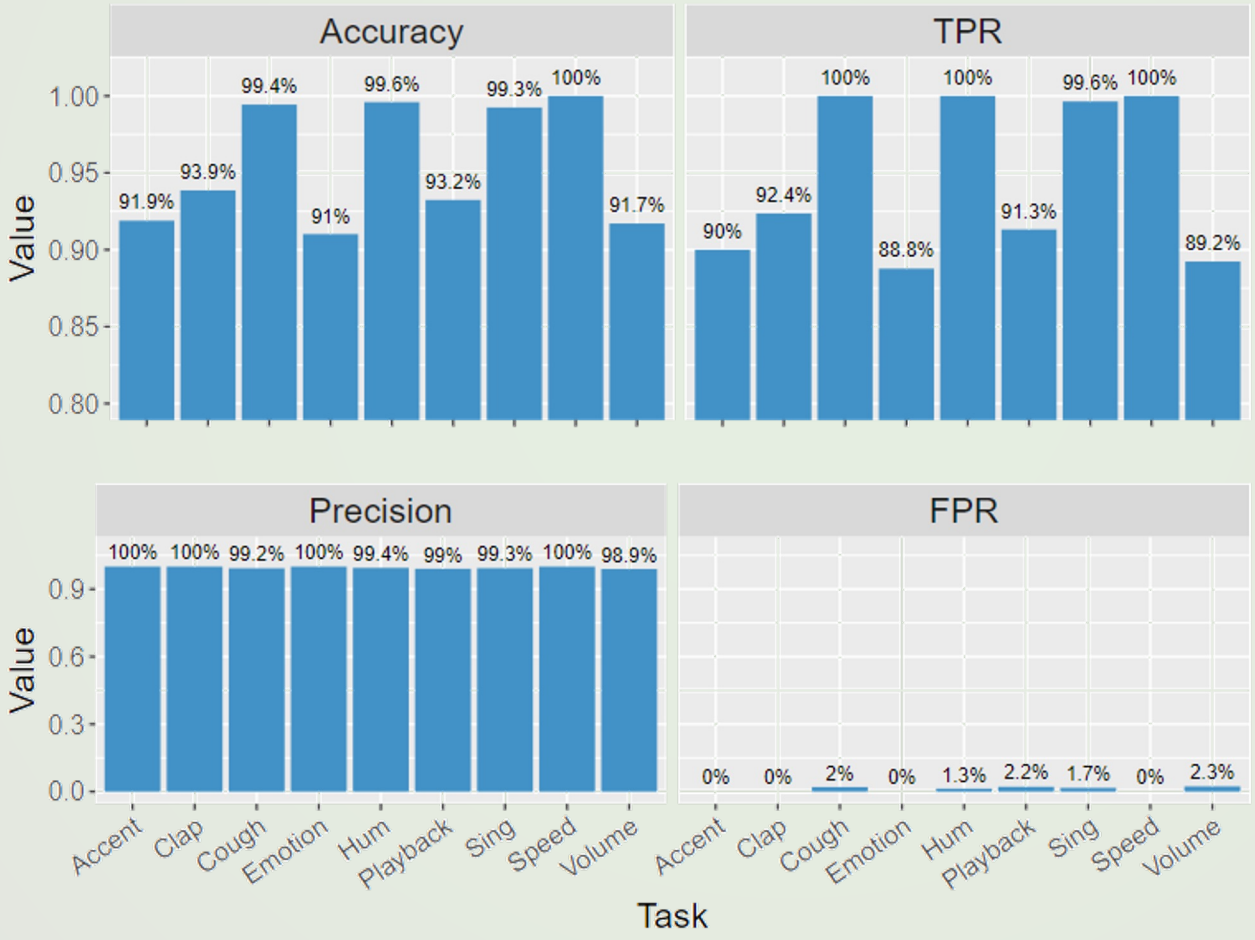
Audio D-CAPTCHA system - Results

The performance of the ensure D-CAPTCHA system (end-to-end)



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Usability Demo

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Thank You!

Frankovits, G.*, Yasur, L.*, Grabovski, F. M., & Mirsky, Y. (2023). Deepfake CAPTCHA: A Method for Preventing Fake Calls (ASIA CCS ’23 Conference)

Frankovits, G., Mirsky, Y. (2023). Discussion Paper: The Threat of Real Time Deepfakes (WDC ’23 Workshop)

Deepfake CAPTCHA Demo

Questions

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