



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

itee^{PhD}
information technology
electrical engineering



Alessandro Pianese

Audio Deepfake Detection Using Pre-trained Models

Tutor: Giovanni Poggi

Cycle: XXXVIII

Year: SECOND

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My background

- MSc degree in Computer Science, Intelligent systems and visual computing – University of Groningen
- Research group: GRIP (Image Processing Research Group)
- PhD start date: 03/01/2023
- Scholarship type: PNRR - Centro Nazionale CN1 HPC Digital & Smart cities
- Cooperation: Fraunhofer Institute for Digital Media Technology

Research field of interest

- **Multimedia Forensics:**



Analysis of media forensic clues

- **Audio Synthesis detection:**



Has this audio been generated? Is the speaker who it claims to be?

- **Multimodal Deepfake Detection:**



Has the video or the audio been tampered with?

Is this real or fake?



Fake

Fake

Fake

Real

Summary of study activities

II year	Courses	Seminars	Research	Tutorship
Total	13	5	35.8	0.54
Expected	10 - 20	5 - 10	10 - 35	0 – 1.6

- Use of pre-trained models for audio deepfake detection.
- Study of the state-of-the-art methods for single modality and multimodality audio/visual deepfake detection.
- **PhD School:**
 - 2024 IEEE SPS / EURASIP - Summer School on Signal Processing, University Federico II
- **PhD courses:**
 - *Strategic Orientation for STEM Research & Writing – Prof. Chie Shin Fraser*
 - *Innovation and Entrepreneurship – Prof Pierluigi Rippa*
- **Conferences:**
 - *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Seoul, Republic of Korea, Apr 14-19, 2024*
 - *ACM Workshop on Information Hiding and Multimedia Security (IHMMSec), Baiona, Spain, Jun 24-26, 2024*

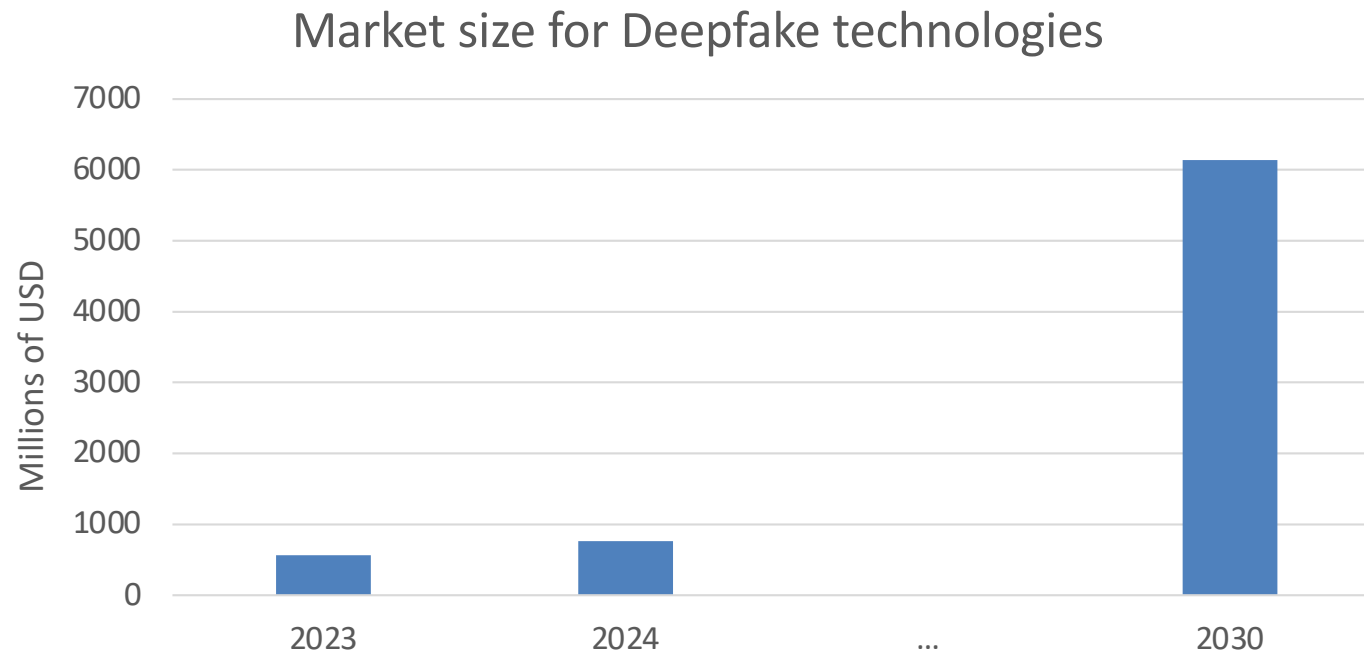
Research activity: Overview

- Deepfakes are a threat to modern society:
 - High quality and easily generated in different languages
 - Mass spread over social media
 - Can influence people the wrong way



Research activity: Overview

- Projections shows a 6-fold increase in market share by the end of the decade [1]
- Deepfakes are here to stay



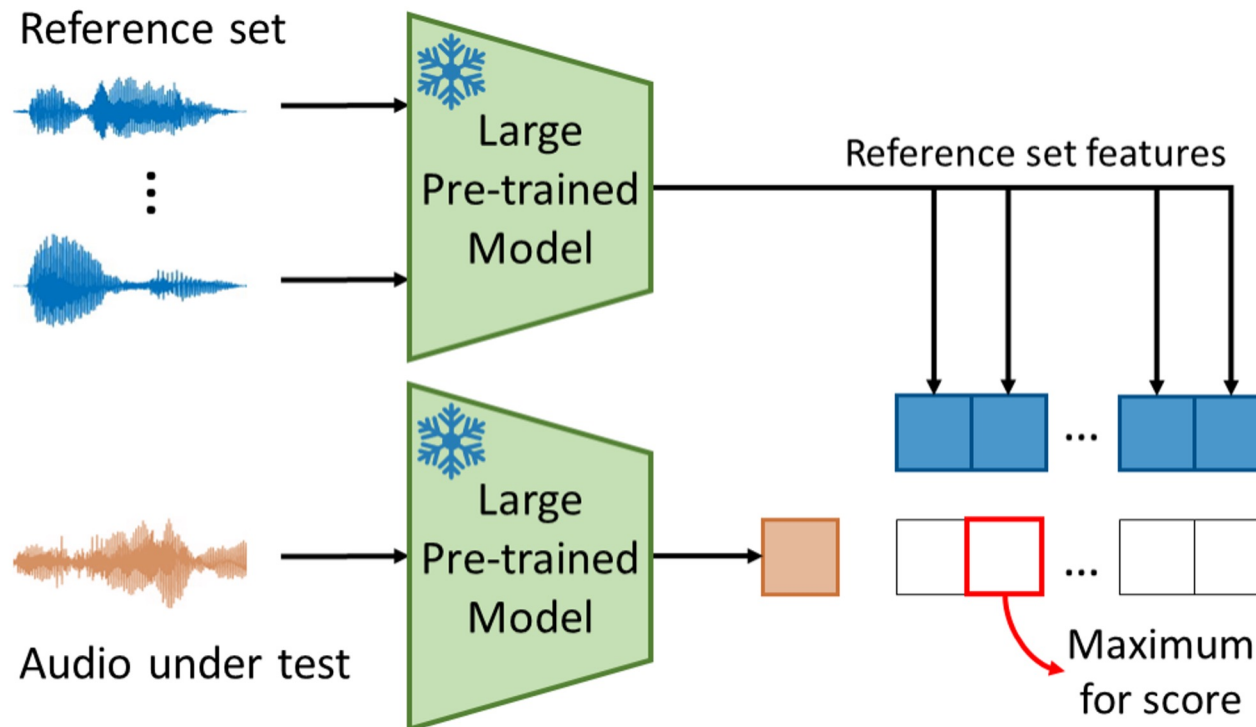
[1] <https://www.grandviewresearch.com/industry-analysis/deepfake-ai-market-report>

Research activity: Overview

- Problem:
 - Deepfakes are **easy to make** and **easy to spread**
 - They have the capability of **influencing people**
 - Existing supervised-trained models **performs poorly on unseen distributions**
- Objective:
 - Develop techniques for **reliable** audio/visual deepfake detection
 - Improve **generalization** capability on new generative models

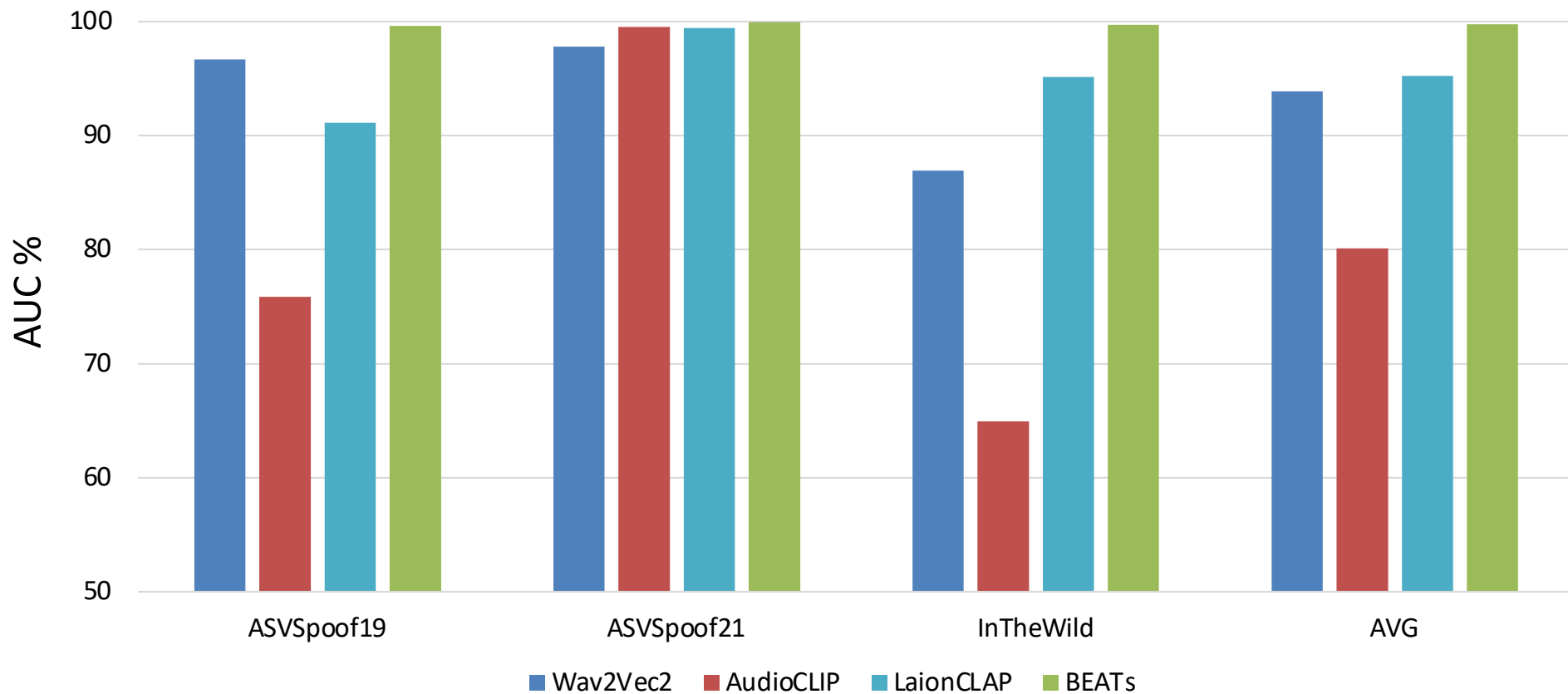
Research activity: Methodology

- **Identity based approach:** we verify if a given audio matches in the embedding space with real audios from the same identity
- Our approach **does not require knowledge of fake data**, generalization is automatically ensured



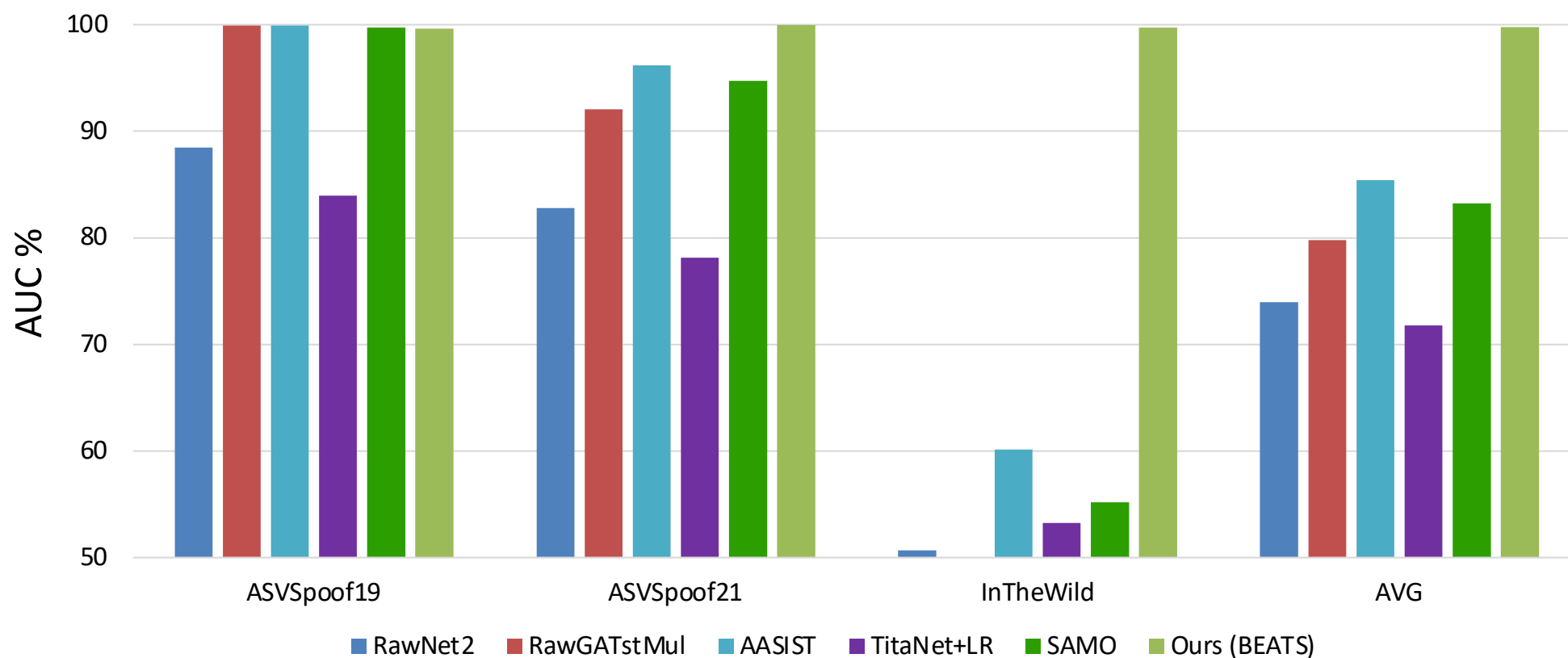
Research activity: Ablation

- Comparison of four state of the art audio pre-trained models
- Best results are achieved using BEATs (Audio Pre-Training with Acoustic Tokenizers)



Research activity: Results

- Comparison with SOTA supervised methods (trained on ASVSpooof19)
- Our proposal can generalize better on new generative models



Products

[P1]	Workshop paper A. Pianese , D. Cozzolino, G. Poggi, L. Verdoliva, "Training-Free Deepfake Voice Recognition by Leveraging Large-Scale Pre-Trained Models", in ACM Workshop Information Hiding and Multimedia Security (IHMMSec), 2024, Baiona, Spain
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Next Year

- Dwell deeper into audio-video deepfake detection
- Use handcrafted features to perform explainable speaker verification

Thank you for the attention!