Fabrizio Guillaro

Noise fingerprint analysis for image forgery detection and localization

Tutor: Prof. Luisa Verdoliva
co-Tutor: Prof. Giovanni Poggi

Cycle: XXXVII   Year: Second

My background

- **MSc degree** in Computer Engineering – Università degli Studi di Napoli Federico II

- **Research group**: GRIP (Image Processing Research Group)

- **PhD start date**: 01/11/2021

- **Scholarship type**: UNINA - DII, DISCOVER project, funded by DARPA under the SEMAFOR program

Research field of interest

- **Multimedia Forensics**:
  - Analysis of forensic clues from visual data

- **Image Forgery Detection**:
  - Is the image fake? Has the image been manipulated?

- **Image Forgery Localization**:
  - Which part of the image has been manipulated?

Score

0.98

FAKE

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  Analysis of forensic clues from visual data

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FAKE

Summary of study activities

II year	Courses	Seminars	Research	Tutorship
Total	14	4.1	41.1	0.28
Expected	10 - 20	5 - 10	30 - 45	0 – 1.6

- Study of the state-of-the-art methods for image forgery detection and localization and for synthetic image generation

- **PhD School:**
  - *International Computer Vision Summer School* (**ICVSS**) 2023 – University of Catania
- **PhD courses:**
  - *How to boost your PhD* - Prof. Antigone Marino
  - *Statistical Multimedia Security and Forensics* - Prof. Fernando Pérez-González, at University of Trento
- **Conference:**
  - IEEE *International Workshop on Information Forensics* (**WIFS**), (online) Dec 13-16, 2022
  - IEEE/CVF *Computer Vision and Pattern Recognition Conference* (**CVPR**), Vancouver, Jun 18-22, 2023

Research activity: Overview

- Problem
  - **Editing** and **sharing** of images is becoming simple
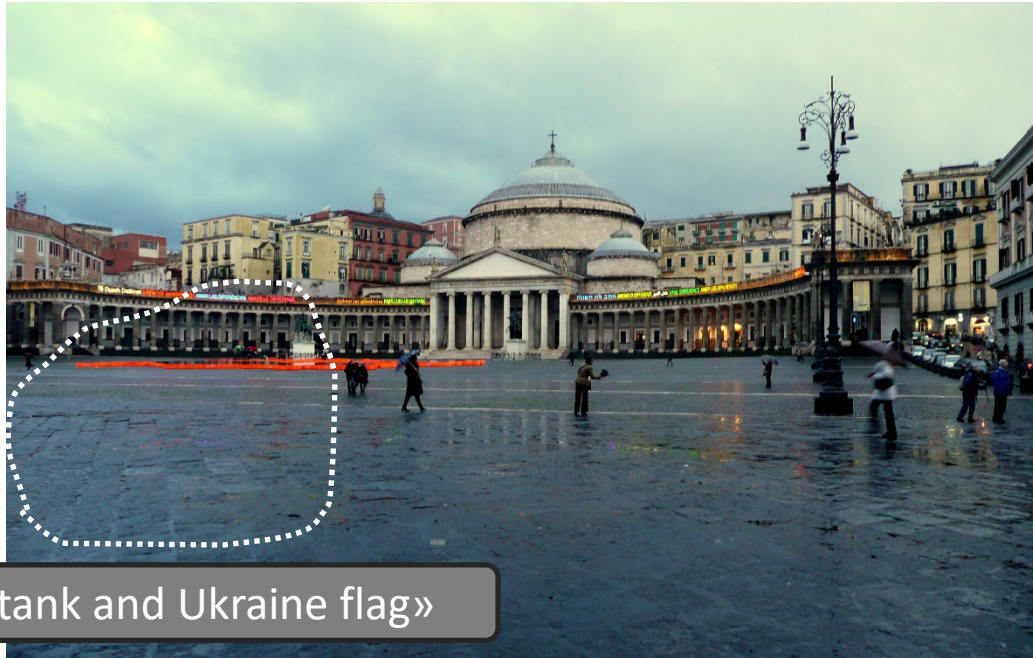

«A cat in the backpack»
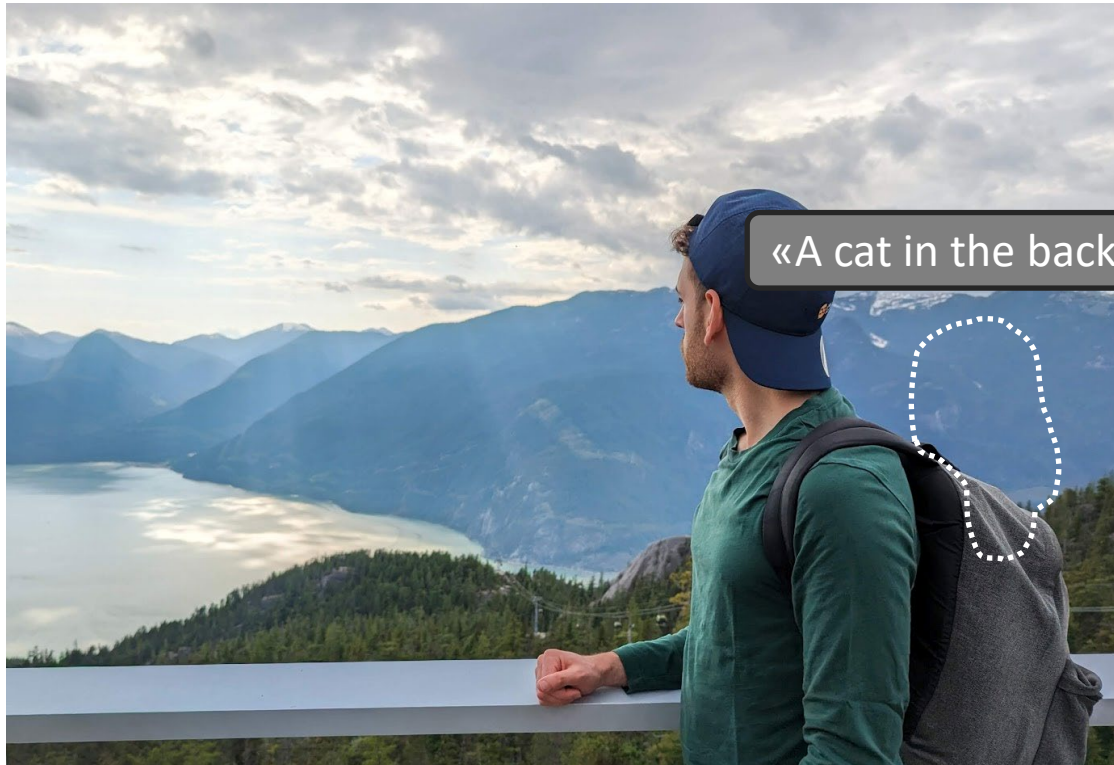
Research activity: Overview

- Problem
  - **Editing** and **sharing** of images is becoming simple

Research activity: Overview

- Problem
  - **Editing** and **sharing** of images is becoming simple
  - It can also represent a **threat**

«A tank and Ukraine flag»

Research activity: Overview

- Problem
  - **Editing** and **sharing** of images is becoming simple
 - It can also represent a **threat**

Research activity: Overview

- Problem
  - **Image Editing** has become very simple
  - Image manipulation can represent a threat and be used to spread **disinformation**
  - If such images are shared over **the web** then distinguishing real from fake is more challenging

- Objective
  - Develop techniques for a **reliable** image forgery **detection** and **localization**
  - Design methods that are **robust** to post-processing operations, such as re-compression
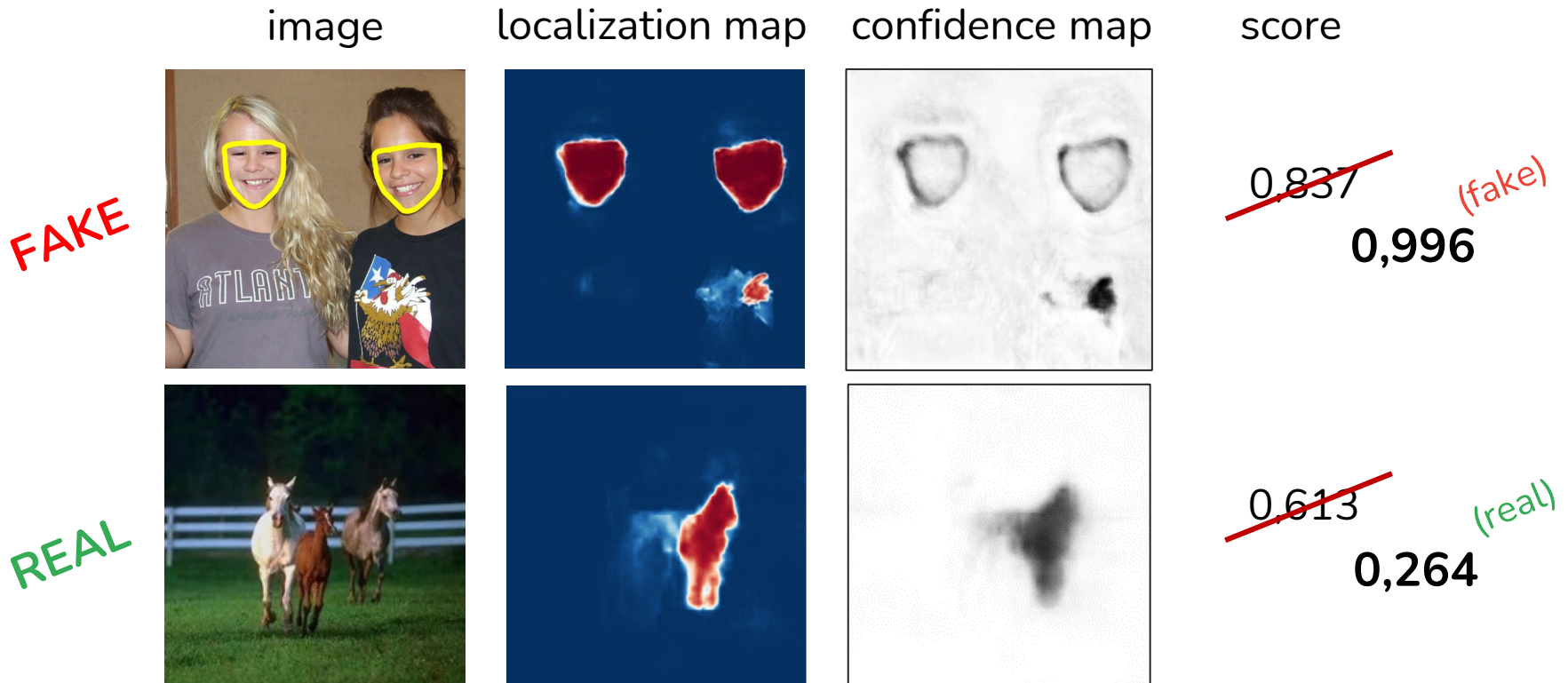
Research activity: Overview

- ## Methodology
  - Extraction and analysis of **noise fingerprint** to detect inconsistencies
  - **Cross-modal fusion** of RGB and Noise features
  - **Confidence estimation** for a pixel-level confidence of the prediction
  - Analysis of localization and confidence maps for a more reliable image-level **detection**
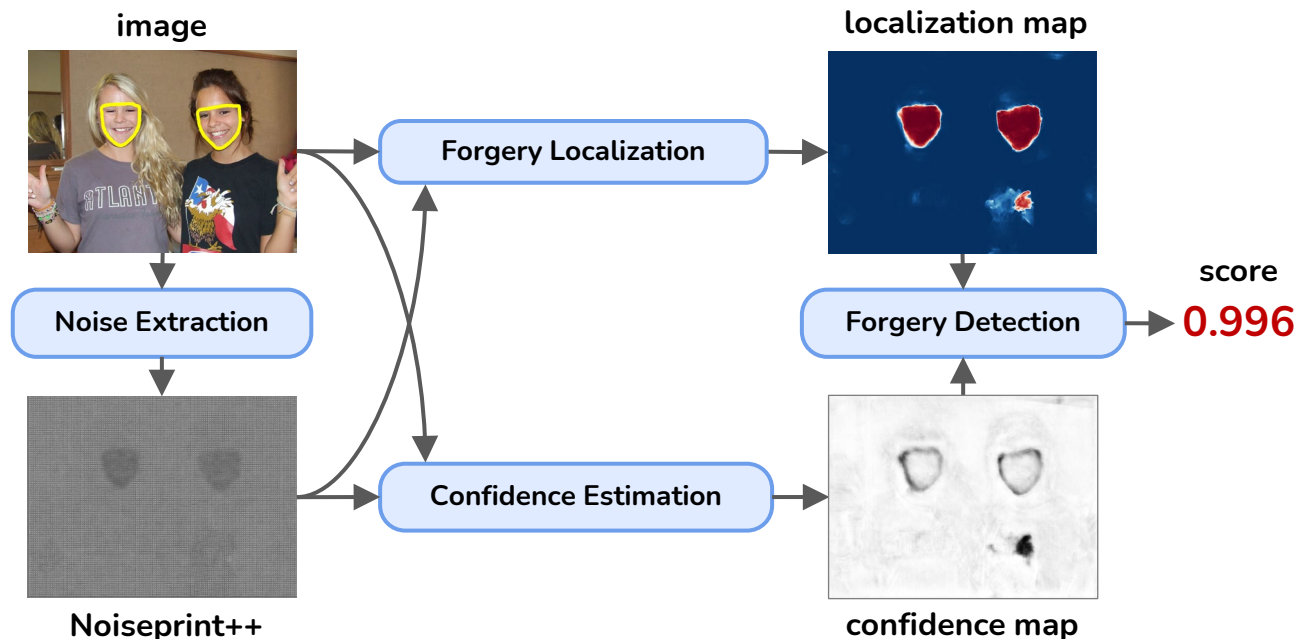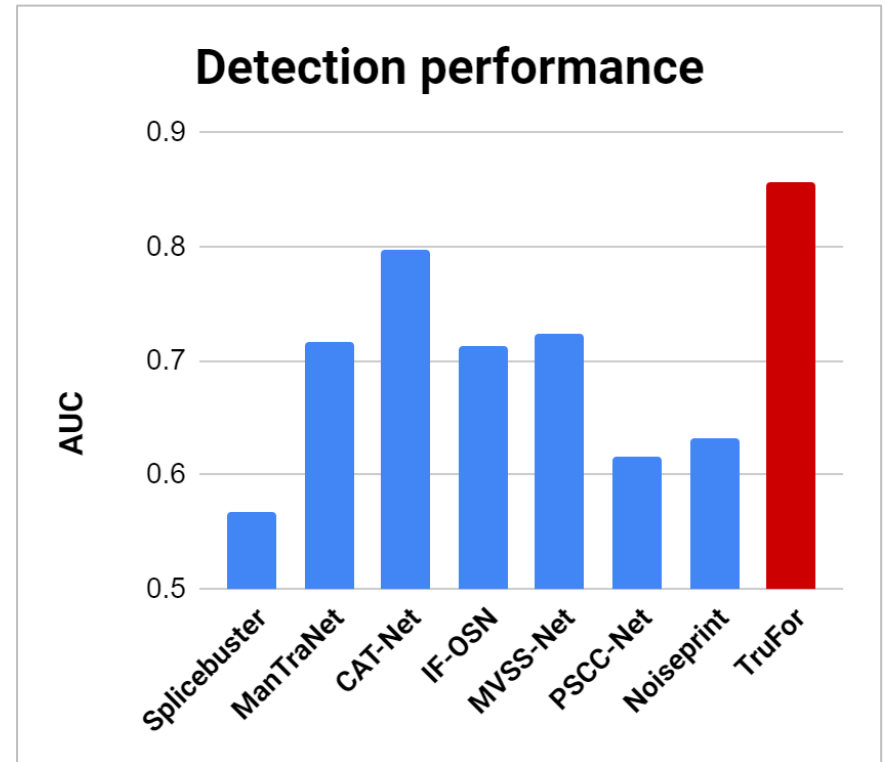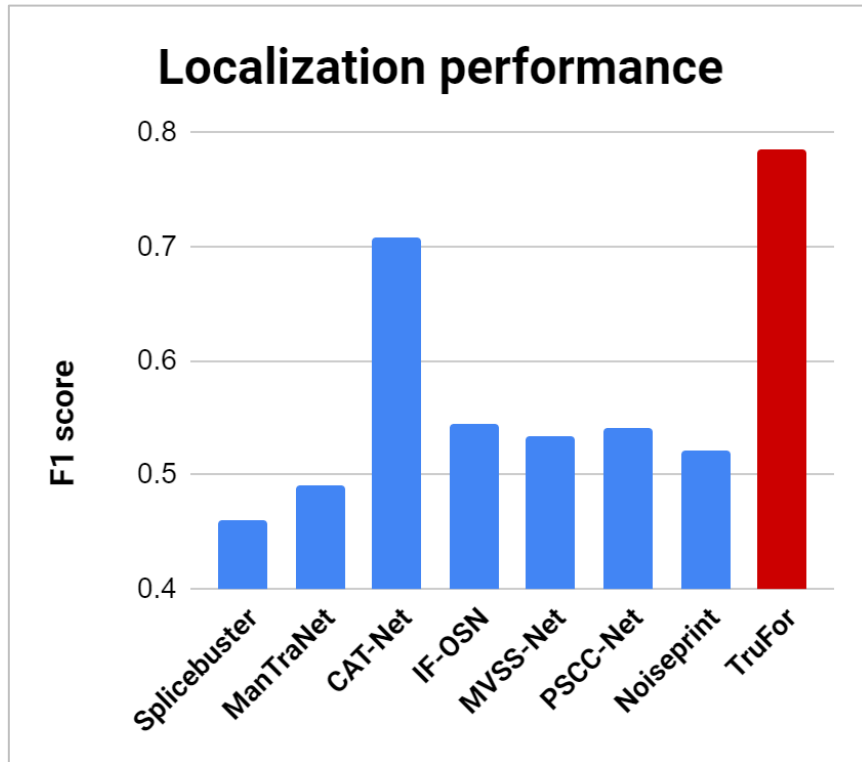
Research activity: Results

- False positives in the localization map do not affect the final score

image	localization map	confidence map	score

FAKE

~~0,837~~ *(fake)*

0,996

REAL

~~0,613~~ *(real)*

0,264

Research activity: Results

Localization performance

Detection performance

Products

	Conference Paper Google Research
[P1]	**F. Guillaro**, D. Cozzolino, A. Sud, N. Dufour, and L. Verdoliva "TruFor: Leveraging all-round clues for trustworthy image forgery detection and localization" in *IEEE Conference on Computer Vision and Pattern Recognition* (CVPR), June 2023, Vancouver, pp. 20606-20615

Next Year

- Improve the proposed methodology to reduce false positives directly in the localization map

- Target recent AI-generated local manipulations

- **Period abroad**:
  - Google LLC, Mountain View, California, USA, starting October 28th

Thank you for the attention!