



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

itee_{PhD}
information technology
electrical engineering



Fabrizio Guillaro

Noise fingerprint analysis for image forgery detection and localization

Tutor: Luisa Verdoliva

Cycle: XXXVII

co-Tutor: Giovanni Poggi

Year: First

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

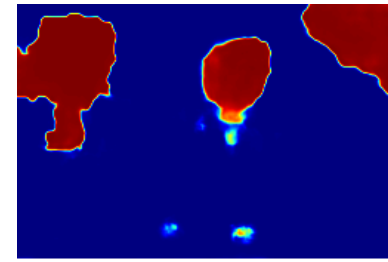
- **Multimedia Forensics:**
 - Develop tools to extract and analyze clues from visual data for a number of forensic applications, e.g. source identification, digital integrity analysis
- **Image Forgery Detection:**
 - Verification of Image authenticity: provide an image-level score
- **Image Forgery Localization:**
 - Identification of manipulated areas: provide a pixel-level localization map



Image under test



Ground truth



Localization map

Summary of study activities

	Courses	Seminars	Research	Tutorship
Total	26	10.8	23	1.28
Expected	20 - 40	5 - 10	10 - 35	0 – 1.6

- Study of state of the art in image forgery detection and localization
- **PhD School:**
 - “DeepLearn 2022 Summer School – 6th Gran Canaria School on Deep Learning”
- **PhD courses:**
 - “Introduction to Deep Learning” (Prof. Giovanni Poggi, Dr. Diego Gragnaniello)
- **MSc courses:**
 - “Visione per Sistemi Robotici” (Prof. Giovanni Poggi, Dr. Davide Cozzolino)
 - “Image and Video Processing for Autonomous Driving” (Prof. Luisa Verdoliva)
- **Conference:**
 - Intl. Conference on Pattern Recognition (ICPR), Montréal, Aug 21-25, 2022

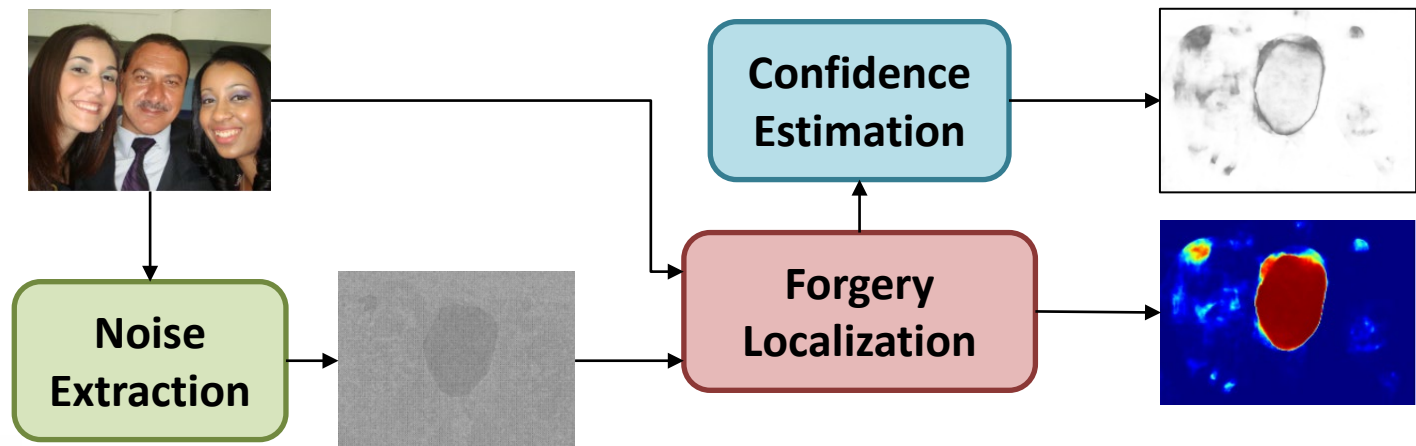
Research activity: Overview

- Problem
 - Easy access to editing tools and social media makes it simple to spread **misinformation**
 - **Images «in-the-wild»** (i.e. from the web) are more difficult to analyze
- Objective
 - Develop techniques for image forgery **detection** and **localization** to fight misinformation
 - Design methods that are **robust** to re-compression and other possible forms of post-processing

Research activity: Overview

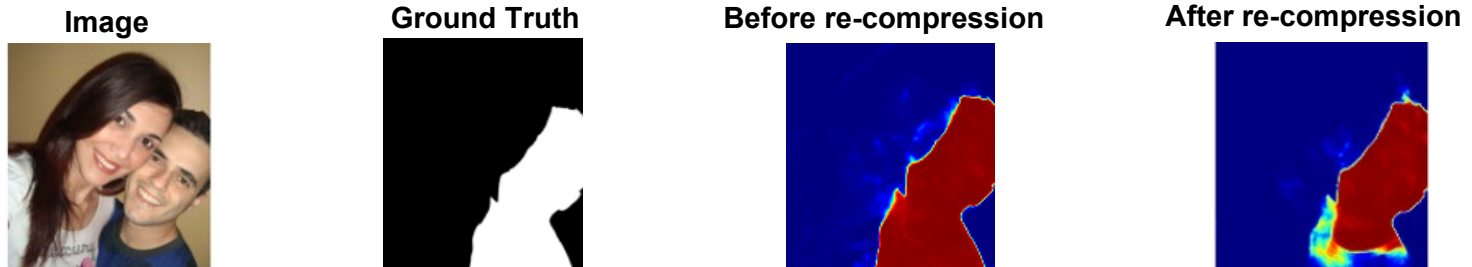
- Methodology

- **Analysis of Noise residual** to detect inconsistencies between regions of the image using a **contrastive learning** approach
- **Cross-modal fusion** of RGB and Noise features
- **Confidence estimation** to provide the user with some understanding on whether the output can be trusted or not
- **Validation** on public available datasets (e.g. CASIA, NIST16, DSO-1)

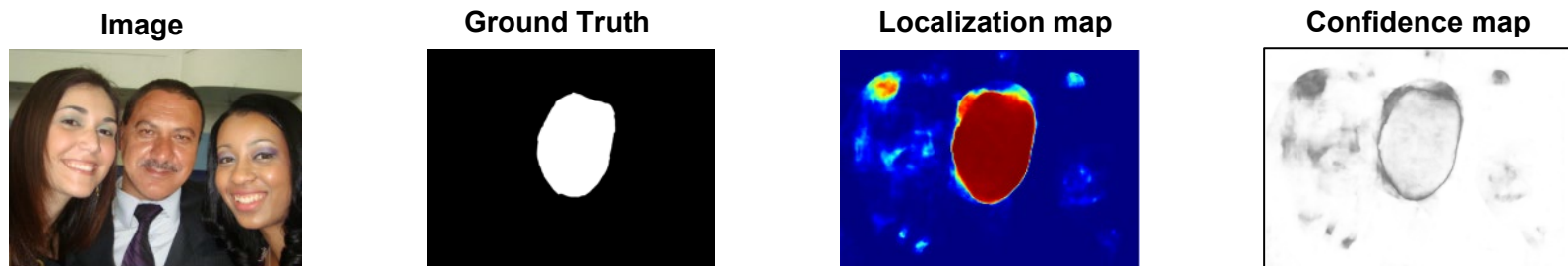


Research activity: Overview

- Robustness to re-compression



- Confidence analysis can help to identify False Positives



Products

[P1]

Conference Paper

H. Mareen, D. Vanden Bussche, **F. Guillaro**, D. Cozzolino, G. Van Wallendael, P. Lambert, L. Verdoliva

"Comprint: Image Forgery Detection and Localization using Compression Fingerprints"
in *Proceedings of the International Conference on Pattern Recognition (ICPR) 2022, Montréal*

Tutorship

- Teaching assistance for the course “Elaborazione di Segnali Multimediali” (32 hours)

Next Year

- Extend the proposed methodology to detect AI-generated manipulations
- Develop a spatio-temporal approach that can detect and localize manipulations in videos

Thank you for the attention!