

Internship proposal

Modeling of Printing-and-Digitalization process using generative methods

Keywords: Generative learning, image processing, printable unclonable codes

Context of the study

Due to development and broad availability of high-quality printing and scanning devices, the number of forged or counterfeited products and documents is dramatically increasing. One of the most promising and cheap solutions is the use of Copy Detection Patterns (CDP) [1]. A CDP is a maximum entropy image, generated using a secret key or password, that takes full advantage of information loss principle during printing-and-scanning process.

The CDPs are printed at the limit of physical resolution of printing devices, therefore the authentication systems take a full advantage of Printing-and-Digitalization (PD) process. In current stage, we need to print a big quantity of samples to learn the authentication detectors. Nevertheless, the dataset construction process is very expensive and time-consuming process. Additionally, the data collection process requires dedicated personnel and very strict procedures.

This internship is a part of ANR project *TRUSTIT: Theoretical and practical study of physical object security in real world use cases* that aims to explore the potential offered by deep learning methods in the context of CDP secure printing from the verifier's point of view.

Description of the subject

The generative neural networks (GANs) and latent diffusion models recently have showed their efficiency in data generation and style transfer [2,3]. During this internship we will work on learning a surrogate representation of the degradations added during Printing-and-Digitalization (PD) process to the CDP. The main tasks of this internship are:

- 1) To learn a surrogate representation of one pair printer-scanner using existing large dataset of printable unclonable codes [4].
- 2) To experiment with different architectures of GANs and diffusion networks to identify the best approach for our task.
- 3) To compare the pseudo-synthetic samples with real printed CDP using some commonly used metrics as Pearson correlation, Mean square error (MSE) distance and Fréchet Inception Distance (FID) between the datasets [5].

Required profile

- The candidate must currently be enrolled in a Master 2 program or in the final year of engineering school (that corresponds to Bac+5 in France) in Computer Science.
- Programming languages: Python.
- Libraries for image analysis and processing: OpenCV, scikit-image (Python).
- Machine learning frameworks: scikit-learn, Pytorch.
- Scientific knowledge: signal processing, image analysis, machine learning and deep learning. Knowledge in multimedia security will be considered a plus.
- Languages: French or English.

Place and allowance of internship

The internship will be held in LIRIS (Laboratoire d'Informatique en Image et Systèmes d'information) laboratory, campus of Université Lumière Lyon 2, Bron. Internship allowance is about 650 euros/month (4.05 euros per hour).

If the internship is successful, a student can pursue with a PhD thesis on the similar topic funded by ANR TRUSTIT project.

Contact information

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Please provide your CV, the motivation letter, and the transcripts with your marks for the last two years of studies.

References

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