Internship proposal

Internship subject

Machine learning approach for classification of patterns printed using a rotogravure process

Keywords:

Machine learning, image classification, image features, sparse coding

Context of the study

The worldwide market is suffering from packaging counterfeiting. According to the Association for Packaging and Processing Technology, such a threat is predicted to increase three percent per year worldwide [1]. Medical supplies represent one of the most sensitive markets: counterfeiting affects health of common people and provokes market lost and damage of brand reputation.

In the PackMark project (CEFIPRA project N° 7127), we aim at developing security elements [2-4] for protection of medicine packaging that are produced using rotogravure printing on aluminum foils. These security elements will help to minimize the replication process and scan-and-print counterfeits and to improve the product security by different levels of protection.

The rotogravure printing technique is worldwide used for medicine blister foils production. This printing process has some features that can be useful to fight the increasing number of counterfeit medicine products. We have done the state-of-the-art study and have shown experimentally the existence of printer and cylinder signature [5].

Description of the subject

We want to analyze the images obtained after printing the security pattern in different conditions:

1) Samples printed on strips and foils.
2) Samples printed using two different types of cylinders (cylinders engraved using chemical process and cylinders engraved using electro-mechanical process).

We have constructed the image databases taking into account these conditions. The preliminary studies have shown the effectiveness of sparse codding approach for image separation.

During this internship we want to study some machine learning approaches in order to identify the samples printed in different conditions.

The objective of this internship are as follows:

1) Develop a/some machine learning method/s to separate the images obtained using different conditions discussed above.
2) Identify the methods that are more effective for each kind of samples.
3) (if necessary) Make the database augmentation using the GAN, for deep learning approach.

This internship will be the collaboration of researchers that work in Laboratory of Hubert Curien in Saint-Etienne and in LIRIS (Laboratoire d'Informatique en Image et Systèmes d'information) in Lyon.

Required profile

- The candidate must currently be enrolled in a Master 2 or in the final year of engineering school (that corresponds to Bac+5 in France) in Computer Science.
- Programming languages: C++, Python.
- Programming tools for image analysis: OpenCV (C++ or Python).
- Scientific knowledge: machine learning and deep learning. The knowledge in image processing and analysis will be a plus.
- Languages: French or English.

References

[1] PMMI's full 2016 Brand Protection and Product Traceability report: https://www.pmmi.org/pmmi-news/global-anti-counterfeiting-solutions-growing-protect-brands-and-consumers.

[2] J. Picard, "Digital authentication with copy-detection patterns," in Electronic Imaging 2004. International Society for Optics and Photonics, 2004, pp. 176–183.

[3] S. B. Pollard, S. J. Simske, and G. B. Adams, "Model based print signature profile extraction for forensic analysis of individual text glyphs," in Information Forensics and Security (WIFS), 2010 IEEE International Workshop on. IEEE, 2010, pp. 1–6.

[4] I. Tkachenko, W. Puech, C. Destruel, O. Strauss, J.-M. Gaudin, and C. Guichard, "Two-level QR code for private message sharing and document authentication," IEEE Transactions on Information Forensics and Security, vol. 11, no. 3, pp. 571–583, 2016.

[5] I. Tkachenko, A. Trémeau, T. Fournel. Authentication of Medicine Blister Foils: Characterization of the Rotogravure Printing Process. VISIGRAPP (4: VISAPP) 2019: 577-583.

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Please provide your CV, the motivation letter and the transcripts of marks for two years of Master's degree / the last two years of engineering school.