

## Accepted Manuscript

Probabilistic modelling of printed dots at the microscopic scale

Quoc Thong Nguyen, Yves Delignon, François Septier, Anh Thu Phan Ho

PII: S0923-5965(18)30024-9  
DOI: <https://doi.org/10.1016/j.image.2018.01.003>  
Reference: IMAGE 15318

To appear in: *Signal Processing: Image Communication*

Received date : 28 September 2017  
Revised date : 8 January 2018  
Accepted date : 9 January 2018

Please cite this article as: Q.T. Nguyen, Y. Delignon, F. Septier, A.T.P. Ho, Probabilistic modelling of printed dots at the microscopic scale, *Signal Processing: Image Communication* (2018), <https://doi.org/10.1016/j.image.2018.01.003>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



## Probabilistic Modelling of Printed Dots at the Microscopic Scale

Quoc Thong Nguyen<sup>a</sup>, Yves Delignon<sup>b</sup>, François Septier<sup>b</sup>, and Anh Thu Phan Ho.<sup>c</sup>

<sup>a</sup>Université de Bretagne Sud, Laboratoire de Mathématiques de Bretagne Atlantique, UMR CNRS 6205,  
Campus de Tohannic, Vannes, France

<sup>b</sup>IMT Lille Douai, Université Lille, CNRS UMR 9189 - CRISTAL, F-59000 Lille, France

<sup>c</sup>Université de La Rochelle, Laboratoire L3i, La Rochelle, France

---

### Abstract

Microscopic analysis of paper printing shows regularly spaced dots whose random shape depends on the printing technology, the configuration of the printer as well as the paper properties. The modelling and identification of paper and ink interactions are required for qualifying the printing quality, for controlling the printing process and for application in authentication as well. This paper proposes an approach to identify the authentic printer source using micro-tags consisting of microscopic printed dots embedded in the documents. These random shape features are modelled and extracted as a signature for a particular printer. In the paper, we propose a probabilistic model consisting of vector parameters using a spatial interaction binary model with inhomogeneous Markov chain. These parameters determine the location and describe the diverse micro random structures of microscopic printed dots. A Markov chain Monte Carlo (MCMC) algorithm is thus developed to approximate the Minimum Mean Squared Error estimator. The performance is assessed through numerical simulations. The real printed dots from the common printing technologies (conventional offset, waterless offset, inkjet, laser) are used to assess the effectiveness of the model.

**Keywords:** Probabilistic model; Bernoulli process; Metropolis Hastings within Gibbs; Microscopic printing; Markov chain.

---

\*Corresponding author

Email address: quoc-thong.nguyen@univ-ubs.fr (Quoc Thong Nguyen)

Download English Version:

<https://daneshyari.com/en/article/6941645>

Download Persian Version:

<https://daneshyari.com/article/6941645>

[Daneshyari.com](https://daneshyari.com)