Master Internship Proposal :
Implementation and Benchmark of Image Restoration Methods using Deep Learning

Supervisors :

- Florian Lemarchand, PhD Student
- Maxime Pelcat, Associate Professor HDR

Keywords : Image Processing, Deep Learning, Image Denoising, Restoration

Context

All data processing systems introduce distortions and noise while processing. Indeed, noise is inherent to analog electronic devices, and digital processing also introduces noise through rounding (in amplitude) and sampling (in time). Although electronic circuits are ever more accurate, none of them can claim noiseless processing. Different sources of noise appear along the stream of data from sensors to actuators. Denoising is thus needed when noise jeopardizes the interpretation of the data.

Deep learning algorithms have recently revolutionized most signal processing problems. These algorithms build from data some trained models that have an extreme ability to fit complex problems. Different trained models exist that solve image denoising and restoration problems. These models are either classified as supervised or unsupervised. The differentiation between supervised and non-supervised comes from the required training data. While a supervised learning model has an access to "clean" data as a reference, unsupervised learning only has an access to noisy data when learning to restore images.

The VAADER team from IETR (Institut d'Electronique et de Télécommunications de Rennes) holds an expertise in image processing and embedded low energy processing. This internship will act as a support for the PhD thesis of Florian Lemarchand on image restoration in a context of images intercepted from unwanted signals. The objectives of the internship are thus

closely related to research objectives and will aim at obtaining novel image restoration methods.

Task

The objective of the internship is to develop and evaluate novel methods to improve image restoration. Different types of deep learning algorithms will be considered being supervised or semi-supervised. The architectures of interest are the following but not limited to : Convolutionnal Neural Networks (CNN), Auto-Encoders, Variationnal Auto-Encoders (VAE) or Generative Adversarial Networks (GAN).

The internship will leverage on the OpenDenoising benchmark [1] developed by the IETR VAADER team.

Requirement

The candidate is expected to be a master student with background in signal processing and especially image processing.

Python language is required, Matlab and C++ are a plus.

Knowledge and previous experiences with learning frameworks like Tensorflow, Keras, PyTorch are also appreciated.

Employment Details

- Application Procedure : Resume and motivation letter addressed to the undermentioned contacts

- Start : January - March 2020

- Duration : 4 months+ (6 months applications will have preference)

- Location : IETR CNRS 6164, VAADER Team, INSA Rennes, 20 avenue des buttes de Coësmes, 35700 Rennes

- Salary : About 550 € per month

- Contacts : florian.lemarchand[at]insa-rennes.fr

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[1] `https://github.com/opendenoising/benchmark`

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