FACULTY MENTOR
Deledalle, Charles

PROJECT TITLE
Full-Focus Image Reconstruction

PROJECT DESCRIPTION
Images almost always contain objects that are blurry or out-of-focus. This arises even with high quality cameras as blur results most often from an incorrect setting of the camera focus, a camera shake, or when an object is moving or localized outside the camera depth of field. The strength and effect of blur is by nature unknown and spatially variable in the image field and depends essentially on the depths (distances of the objects from the camera) and motions of the objects. Image deblurring has made tremendous improvements in the last few years with the emergence of deep convolutional neural networks. Such techniques nevertheless neither accurately deblur an image when the blur is non-stationary, nor do they provide a point-wise estimate of the blur, depth and motion. Yet estimating blur, depth and motion is essential for scene understanding. In this context, the goal of this internship is to investigate multi-task learning architectures that would jointly estimate the deblurred image and the nonuniform blur. A grad student will help with mentoring.

INTERNS NEEDED
1 MS Student and 1 BS Student

PREREQUISITES
Deep Learning, Image Processing, Optimization, Python. Familiarity with computer graphics would be a plus.
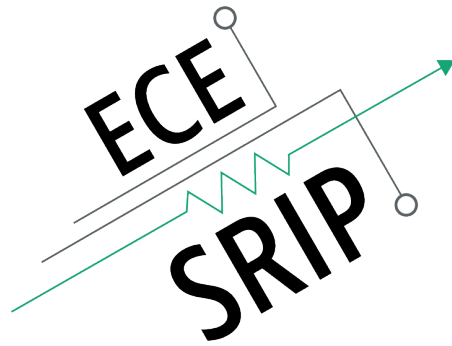
FACULTY MENTOR
Deledalle, Charles

PROJECT TITLE
PNG2SVG: Generating vectorial graphics from rasterized versions
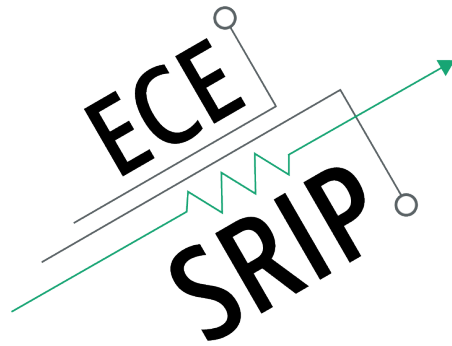
PROJECT DESCRIPTION
Vectorial graphics are images, not defined on a discrete grid of pixels, but described by a sequence of commands placing lines, curves, shapes and so on. The standard Scalable Vectorial Graphic (SVG) format encodes these sequences based on a computer language: XML. The simpler the graphic is, the less commands are required, and the smaller the file size is. Vectorial graphics confer several advantages: they are not limited by the resolution of the grid, are more easily editable, and usually lead to smaller file sizes. Vectorial graphics are used for logos, plots, cartoons, cliparts, fonts, etc. Unfortunately, vectorial graphics are often rasterized before publication, hence leading to resolution losses, larger file sizes, and hardly editable formats. Recently, deep recurrent convolutional neural networks have shown to be efficient at: (i) image captioning, i.e., producing sentences describing images, and (ii) randomly generating syntactically correct computer programs. The purpose of this internship is to take inspiration from these methods to develop a derasterization algorithm that would generate vectorial graphic images from their rasterized versions (at least on simple toy examples).

INTERNS NEEDED
1 MS Student

PREREQUISITES
Deep Learning, Image Processing, Python. Notions of programming language theory would be a plus.

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Deledalle, Charles

PROJECT TITLE
Image restoration with bi-directional GAN priors

PROJECT DESCRIPTION
Generative Adversarial Networks (GANs) have proven to be efficient to capture the manifold of photo-realistic images. Unlike traditional GAN, bi-directional GAN provides a way to project images onto this latent manifold. The traditional image restoration techniques used to rely on linear transforms mapping images back and forth onto an a priori suitable latent space (such as Fourier and wavelet domains). The purpose of this internship is to investigate whether non-linear transforms, especially bi-directional GAN, could be used as a prior in classical Bayesian inference models (at least for domain-specific image reconstruction). Applications include image denoising, deblurring, in-painting, and super resolution.

INTERNS NEEDED
1 MS Student

PREREQUISITES
Deep Learning, Image Processing, Optimization, Linear Algebra, Python.