

Crash Course on Parallel computing for fusion – 24h Técnico.Ulisboa



My name is Sérgio Agostinho, a PhD student working in Computer Vision (CV), focused in Structure from Motion, and I attended the Crash Course on Parallel Computing for Fusion at Instituto Superior Técnico (IST) in Lisbon, from June 20th – 23rd 2016. I work at IST, where I'm part of the Signal Processing Group at Instituto de Sistemas e Robótica.



Figure 1: Panoramic view over Lisbon on top of IST's North Tower.

I decided to enrol in this course because it covered CUDA and OpenMP. CUDA became a prominent framework over this past decade enabling the many exciting applications in many topics of CV, but more recently, driving astonishing results in Deep Learning, by empowering popular frameworks like TensorFlow and Caffe. OpenMP became popular for allowing developers to take full advantage of the now standard multicore architectures, with very minimal effort. Expertise on both constitutes a powerful toolset for developing very efficient implementations of the algorithms I'll be working on, over the course of my PhD.

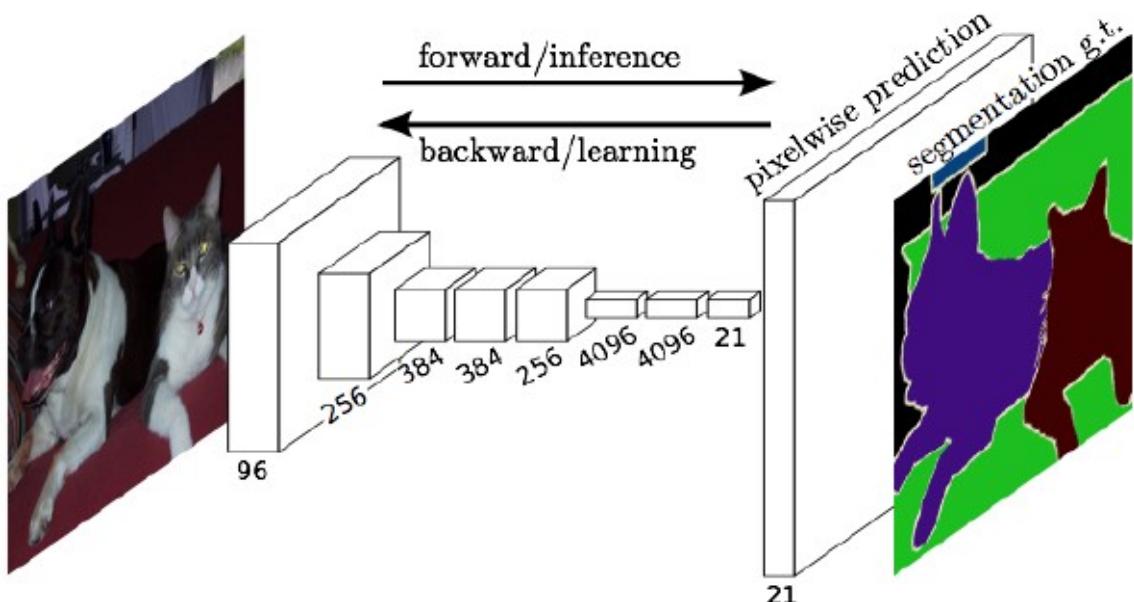


Figure 2: Fully Convolutional Networks for Semantic Segmentation from Long et al. CVPR 2015. Trained using Caffe.

Besides being a PhD student, I'm also a maintainer for a popular library in CV called Point Cloud Library (PCL). PCL is a library focused on manipulating 3D point clouds, and it provides a lot of functionalities to work with this particular data structure. Many of the operations over point clouds, can be parallelized and as such, the library has a number of implementations making use of OpenMP and CUDA e.g.: normal estimation and kinfu (an open source implementation of the Kinect Fusion algorithm), respectively. As a maintainer, I'm responsible for reviewing contributions to the library made by the community and fixing bugs, some of them made with CUDA and OpenMP.

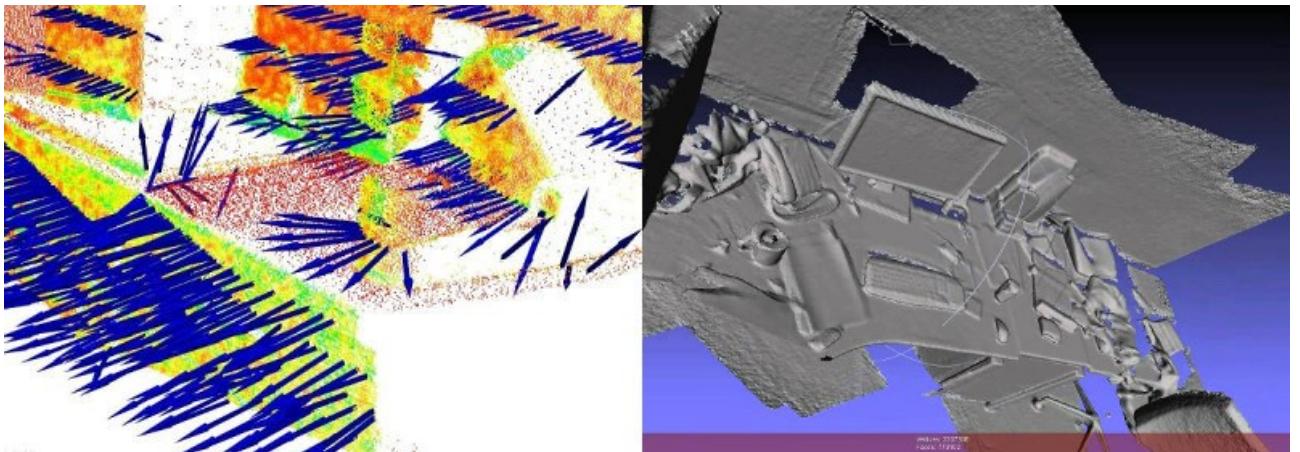


Figure 3: Normal estimation in PCL (left). Kinfu app in PCL (right)

What I found most useful about the course was that it provided a hands-on introduction on three different types of frameworks which cover most needs, in terms of parallelization, a developer might have. CUDA is great when having to perform vectorized operations over high dimensional data, OpenMP allows to easily fully exploit the multicore architectures, and if the problem is too big to be handled by a single machine, that's where MPI comes in and helps approach it from a multi-

machine/cluster perspective.

In this day and age, where parallel computational devices are ubiquitous, this course should be considered mandatory for any entry level developer looking to work in highly intensive computing applications. If you have the opportunity to take it, don't miss the chance.