UNIVERSITÀ DI PISA

DIPARTIMENTO DI INGEGNERIA DELL'INFORMAZIONE

Dottorato di Ricerca in Ingegneria dell'Informazione

Doctoral Course

"Monte Carlo methods and sampling for computing"

Prof. Francesco Banterle

ISTI-CNR – Italy

francesco.banterle@isti.cnr.it

Short Abstract: This course introduces students to Monte Carlo methods and sampling techniques with a focus on visual computing. These are crucial to accelerating the computations of a variety of computational simulations where we need to draw high-quality samples or to integrate a complex multi-dimensional function such as physically-based rendering for computing the radiance of buildings, estimating the price of options, or how epidemics spread out. At the end of this course, students will have both theoretical and practical tools that they can apply to a variety of problems to achieve high-quality solutions. During the course, students will see and study successful examples of this beautiful theory to visual computing; e.g., visual processing, computer vision, finance, etc. .

Course Contents in brief:

- Introduction.
- Monte-Carlo Estimation.
- Monte-Carlo Integration.
- Uniform Random Numbers.
- Non Uniform Random Numbers.
- Variance Reduction techniques.
- Quasi Monte-Carlo.
- Monte-Carlo Applications.

Total # of hours of lecture: 16 hours

References:

[1] Monte-Carlo: theory, method and examples by Art Owen. 2013

[2] Physically-Based Rendering by Matt Pharr, Wenzel Jakob, and Greg Humphreys. 2016

CV of the Teacher

Francesco Banterle is a researcher in the field of Computer Graphics/Vision at the Visual Computing Lab at ISTI-CNR (Pisa, Italy). Before joining the Visual Computing Lab, I was an intern at Arup Ltd (monte-carlo rendering), and previously I did my Ph.D. at Warwick University (Coventry, United Kingdom) on inverse/reverse tone mapping.

His main research fields are high dynamic range (HDR) imaging (acquisition, tone mapping, HDR video compression, and HDR monitors), augmented reality on mobile, and rendering (global illumination, and image-based lighting). Recently, he has been working on applying Convolutional Neural Networks (CNNs) to these fields.

Final Exam: programming project or paper seminar.

Room and Schedule

Room: *Aula Riunioni del Dipartimento di Ingegneria dell'Informazione, Via G. Caruso 16, Pisa – Ground Floor*

Schedule:

Day1 – Introduction; Monte-Carlo Estimation.

Day2 – Monte-Carlo Integration; Uniform Random Numbers.

Day3 – Non Uniform Random Numbers and Variance Reduction Techniques.

Day4 – Quasi Monte-Carlo; Monte-Carlo Applications.