CATMI 2011 Advanced Course REPORT

Computational Algebraic Topology applied to Medical Imagery
(CATMI 2011)
October 17-18, 2011
http://congreso.us.es/catmi2011

CATMI 2011 (Computational Algebraic Topology applied to Medical Imagery) took place in the beautiful village of Chipiona (Cádiz) in Spain during the days October, 17 and 18 of 2011. The lectures were developed in the big conference room of Santa María de Regla student residence house with excellent technical conditions for slide presentation. In CATMI2011 Advanced course, experts in the fields of classical Algebraic Topology, Computational Algebraic Topology, Software Development, Computational Harmonic Analysis and Medical Imagery have given introductory talks on the respective topics in which they are specialists. The timetable of CATMI2011 is at the website http://congreso.us.es/catmi2011.

The speakers of CATMI2011 advanced course were:

-Prof. Carles Broto, “Survey on Algebraic Topology:its motivations and its goals” Univ. Autónoma de Barcelona, Spain
-Prof. Herbert Edelsbrunner, “Persistent Homology” ISTA, Austria
-Prof. Feichtinger, “Computational Harmonic Analysis”, NuGah, Austria
-Prof. Marcos Ortega Hortas, “Different Imaging Modalities”. VARPA, Spain
-Prof. Pedro Real, “Topology-based Digital Image Processing”. CATAM, Univ. de Sevilla, Spain.

Each speaker of CATMI2011 developed its own subject in two lectures of one hour each.

The discussions immediately after the corresponding speech were exciting and very fruitful. Ideas and notions such as: topological representation of digital images, lossless compression, triangulations, chain homotopies, integral-chain complexes, persistent homology, Reeb graphs, homological algebra, directed trees, Hasse diagrams, cell complexes, medical topological correction, Gabor filters, harmonic forms, progressive transmission of images via Internet,

visualization of 3D and 4D (or 3D+t) images, physical topology-based models for images, virtual simulation on images, processing in compressed domain of the image, wavelet, tree-like and raw representation formats for medical images, topological analysis of vessels in retinal images,….

The number of participants in this advanced course was about 30 and the number of PhD students and young researchers about 15. The number of granted people from ESF was ten and from RET (Red Española de Topología) was two.

The main social event related to CATMI2011 Advanced Course was the gala dinner in the evening of Tuesday, October 18. It took place in Restaurante Las Canteras with a spectacular view of the beach in the night and in a friendly ambiance between students and speakers. During this dinner, it was announced that a possible continuation of this experience would be planned for 2012 in collaboration by a group of University of Timisoara (Romania) led by prof. Darian Onchis and a group of University of Wien (Austria) led by prof. Feichtinger.

Immediately after the advanced course, CATMI2011 workshop started at Wednesday, October 19, 2011 and finished October 20 in the evening. Most of the people that first followed the advanced course, specially young researchers, also attended at the workshop and the feedback between speakers and attendees increased in a non-negligent way, mainly at discussion level after the speeches and the poster track in Wednesday.

The main motivation for organizing the CATMI2011 event was to try to create some bridges and information flows connecting Computational Algebraic Topology and related issues with the applied area of Digital Image Processing and, mainly, with the field of Medical Imagery. A common dictionary has started to be created and the interactions are at the level of representation, compression, processing and analysis, visualization, simulations and transmission trough an information channel. A web page http://www.univie.ac.at/nuhag-php/ul/ is active for download slices, papers, images, etc.

The cochairs of CATMI2011, Enrique Macías from University of Santiago de Compostela (Spain) and Pedro Real from Universidad de Sevilla (Spain), are

actually in negotiation with Springer, with the intention of editing a book entirely devoted to Computational Topology and its Applications with a special attention to those methods inspired from Algebra and/or having as motivation medical image applications. This event has been sponsored by European Science Foundation (project “Applied and Computational Algebraic Topology”), i-Math (Ingenio Matematica), RET Red Española de Topología through a Special Action from MICINN Ministerio de Ciencia e Innovación", IMUS (Instituto de Matemáticas de la Universidad de Sevilla) and the research project MTM2009-12716 "4D-Hom: Exploiting the notion of homology in the context of the 4D Digital Imagery". Research groups that have helped to organize CATMI2011 are: CATAM “Computational Algebraic Topology and Applied Mathematics” andalusian research group (FQM-296, http://munkres.us.es:8080/groups/catam/), NuHaG (Numerical Harmonic Analysis Group http://www.univie.ac.at/nuhag-php/home/index.php) and grupo de innovación VIRSSPA (Hospital Universitario Virgen del Rocío, Sevilla).

Sevilla, a 20 de octubre de 2011

D. Enrique Macías Virgos
D. Pedro Real Jurado
Cochairs of CATMI2011

Departamento de Matemática Aplicada I. E. T. S. de Ingeniería Informática. Avda. Reina Mercedes, s/ n. 41012 – SEVILLA.
Tfno. 954552766. Fax. 954557878. http://ma1.eii.us.es/ E-mail: secretarma1@us.es