Noura **HAMZE**

PHD IN COMPUTER SCIENCE

Interactive Graphics and Simulation group
University of Innsbruck, Austria

Technikerstraße 21A, 6020 Innsbruck, Austria
Building 21A, Room no. 3N04
+43 512 507 53386
noura.hamze@uibk.ac.at
http://homepage.uibk.ac.at/~c7031192

Bio: I am a post-doctoral researcher at the Interactive Graphics and Simulation group (IGS) led by Prof. Matthias Harders at the University of Innsbruck, Austria.

Before, I was a researcher and teaching fellow at the University of Strasbourg, France where I fulfilled my PhD in computer science in the Computer Graphics and Geometry group (IGG) at the ICube laboratory, and was directed by Dr. Caroline Essert.

I am generally interested in most areas of computer graphics for surgical purposes. In particular, I focus on geometric modeling, physically-based simulations, geometric constraints solving and optimization techniques. I worked on different domains including neurosurgery, percutaneous procedures and forearm surgery. Beside my research activities, I'm also involved in teaching since 2013 and was charged in a number of courses in both the University of Strasbourg and the University of Innsbruck.

Occupations and Education

Post-doctoral researcher — Nov. 2016 – now

I am working on a D-A-CH project "PROSUP" funded by the Austrian Science Fund FWF and the Swiss National Science Foundation SNSF on the analysis and simulation of the distal forearm stability during pro-supination for improved surgical planning.

Teaching (50%) and research (50%) fellow (ATER) — Oct. 2015 – Aug. 2016

Department of Mathematics and Computer Science / ICube laboratory, University of Strasbourg, France.

PhD in computer science — Oct. 2012 – Jun. 2016

University of Strasbourg, France.

MSc. in computer graphics and geometry — Sep. 2010 – May. 2012

University of Strasbourg, France.

License in computer science - Artificial intelligence — Sep. 2001 – Sep. 2006

University of Aleppo, Syria.

Research Experience

Prosup Project 2016- now

Analysis and simulation of the distal forearm stability during pro-supination for improved surgical planning

Prosup project aim is to develop a patient-specific hard and soft tissue model for simulating the healthy and pathological forearm motion with respect to functional disability and instability. The ultimate goal is to predict the surgical outcome preoperatively by analyzing the forearm motion before and after simulated surgery. This would enable the surgeon to select the optimal treatment specific to the pathology and biomechanics of the patient.

Project directors: Dr. Philipp Fürnstahl, Head of CARD Department, Zürich, Switzerland & Prof. Matthias Harders, Head of IGS Group, Innsbruck, Austria

ACouStiC Project 2014-2016

Computer assisted surgical planning in Deep Brain Stimulation

ACouStiC project addressed an accurate preoperative path planning for electrodes inside the human brain to treat Parkinson disease and essential trumors. The propsed planning approach takes into account a well-known problem of deformation resulting from the "Brain Shift" phenomenon. Furthermore, a new evolutionary approach for multi-objective optimization in neurosurgery surgical planning has been proposed and clinically validated.

Project director: Dr. Pierre Jannin, Research Director at MediCIS, Inserm, UR1 – UMR 1099 LTSI Rennes, France.

Project webpage: http://www.anr-acoustic.org

Haystack Project 2012-1014

Flexible needles trajectory planning in percutaneous procedures

Haystack project addressed accurate preoperative surgical planning for percutaneous ablation of abdominal tumors. The planning takes into account biomechanical deformation because of soft tissue deformation and flexible needle deflection while needles are inserted inside the body. The proposed approach couples a geometric constraint solver with FEM physics simulations.

Project director: Dr. Stéphane Cotin, Research Director at Inria France, leader of MIMESIS team.

Professional Training

- Evolutionary Stochastic Optimization
  Massive Open Online Course “Optimisation Stochastique Évolutionnaire”
  5 Sep. – 3 Nov. 2014, Université de Strasbourg, France.
  Animated by: Prof. Pierre Collet

- Surgical simulators Design
  Summer school “Chirurgical simulators conception”
  30 Jun. – 4 Jul. 2014, INSA de Lyon, France.

Scientific Communications

Publications in international journals with review committee

- Noura Hamzé, Igor Peterlik, Stéphane Cotin, and Caroline Essert. **Pre-operative Trajectory Planning for Percutaneous Procedures in Deformable Environments**, Computerized Medical Imaging and Graphics, Elsevier, page 16-28, Volume 47, January 2016. doi: 10.1016/j.compmedimag.2015.10.002

Publications in international conferences with review committee with proceedings

- Noura Hamzé, Pierre Collet, and Caroline Essert. **Evolutionary approaches for surgical path planning: a quantitative study on Deep Brain Stimulation**. The IEEE Congress on Evolutionary Computation 2017, San Sebastian, Spain.

- Noura Hamzé, Jimmy Voirin, Pierre Collet, Pierre Jannin, Claire Haegelen, and Caroline Essert. **Pareto front vs. weighted sum for automatic trajectory planning of Deep Brain Stimulation.** The 19th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), Athens, Greece, October 2016.

- Noura Hamzé, Pierre Collet, and Caroline Essert. **Introducing Pareto-based MOEA to Neurosurgery Preoperative path planning**, Genetic and Evolutionary Computation Conference (GECCO'16), Denver, United States, July 2016. Short paper / poster. doi: 10.1145/2908961.2909028

- Noura Hamzé, Alexandre Bilger, Christian Duriez, Stéphane Cotin, and Caroline Essert. **Anticipation of brain shift in Deep Brain Stimulation automatic planning**, 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC'15), Milano, Italy, pages 3635 - 3638, August 2015. doi: 10.1109/EMBC.2015.7319180

Manuscripts

- Preoperative path planning and optimization in static and deformable conditions for image-guided minimally invasive surgery.
  Doctorate thesis of Noura Hamzé, 2016

- Perspective geometry textures
  Master's thesis of Noura Hamzé, 2012

Oral communications/Posters without proceedings

- Invited talk: on « trajectory planning in deformable conditions », Altair Robotics lab, Verona, Italy.
- Poster MITK: Presented with a Demo at the German Cancer Research Center DKFZ at MITK Users Meeting 2015. The event took place in Heidelberg, Germany.
- Poster doctoral school: Presented at the doctoral school of mathematics and informatics follow up day after the first year of the thesis. The event took place in Strasbourg, France.

Academic Activities

Teaching:

Teaching took place at the Faculty of mathematics and Informatics at the University of Strasbourg between 2013 and 2016, and at the Department of Computer Science at the University of Innsbruck since 2017 for Bachelor students.

- Computer graphics
- Algorithms and programming
- Methodology of academic work
- Database systems
- Advanced database systems and web programming
- Human-machine interfaces
- Software development techniques

Students' supervision:

- Andrea Rendl: Master thesis, Department of computer science. Since April 2017.
  Thesis title: "Shape analysis for enhanced stability of forearm in surgical planning"
- Lukas Nocker: Bachelor thesis, Department of computer science. Since January 2018.
  Thesis title: "Automatic atlas-based landmark transfer for ligaments identification"

Administrative Responsibilities

- Jan. 2013 - Aug. 2015: Member of the doctoral committee of ICube laboratory.
  A committee of 16 members representing around 150 PhD. students at ICube lab.

Conference Review

- MICCAI'17: The 20th International Conference on Medical Image Computing and Computer Assisted Intervention.

Scientific Memberships

- Member of AFIG (French Association of Computer Graphics) since 2013.
- Member of AFRV (French Association for Virtual, augmented, mixed reality and 3D interaction) since 2015.

Scientific Animation

- 2017 Organizing member of STEM summer school (Sommertechnikum MINT 2017), University of Innsbruck.
- 2015 Student volunteer at Computer Graphics International CGI 2015.
- 2016 Student volunteer at Eurographics conference.

Languages

- Arabic (mother tongue) • French & English (fluent) • German (basics)

Technical Skills

Programming languages	C++ • OCaml
Computer graphics libraries	CGAL • ITK • VTK • GLSL
Medical and simulation platforms	MITK • SOFA
IDEs	QtCreater • Microsoft Visual studio
Operating Systems	Linux Ubuntu • Windows
Database systems	SQL • Oracle
Miscellaneous	Meshlab • Paraview• TetGen • Gmsh • Git • SVN • LaTeX • CMake

Last updated on January 2018