Acquisition and Processing of 3D Geometry (COMP0119)

Description

Aims:
To expose students to the challenges and potential of geometry processing in relevant application areas. To explain how to use acquire 3D model, and subsequently process, analyse, and manipulate the data. To familiarize students with handling real data sets and apply machine learning algorithms in the context of 3D geometric data.

Learning outcomes:
On successful completion of the module, a student will be able to:
1. Read and understand recent advancements in this area (theory);
2. Obtain a grasp of the key tools in geometry processing (theory) and understand current machine learning approaches in the context of geometry processing;
3. Gain necessary coding and practical skills to work directly with real-world 3D data (practice);
4. Learn to formulate and solve problem using the geometric tools they learn as part of the module (practice);

Content:
- The module introduces basics of geometry processing covering important aspects of acquisition, analysis, and manipulation of 3D data. The module will consist of a mix of theory and applications to real-world scenarios;
- The module intends to introduce students to the various stages of a typical geometry processing pipeline. With the recent growth in popularity of 3D acquisition devices (e.g., depth cameras) and modeling frameworks, geometry processing now plays a central role in a diverse set of applications including city planning, architectural geometry, reverse engineering, interactive modeling, etc;
- Topics will include but not restricted to mesh representations, mesh smoothing, remeshing, mesh reconstruction, and shape analysis. Necessary topics in differential geometry will be covered in the module;

Introduction:
- Applications;

Key information

Year: 2019/20
Credit value: 15 (150 study hours)
Delivery: PGT L7, Campus-based
Reading List: View on UCL website
Tutor: Prof Niloy Mitra
Term: Term 2
Timetable: View on UCL website

Assessment

- Coursework: 25%
- Coursework: 40%
- Oral examination (departmentally managed): 5%
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Find out more

For more information about the department, programmes, relevant open days and to browse other modules, visit ucl.ac.uk

Disclaimer: All information correct as of June 2019. Please note that aspects of the module may be subject to change. UCL will make best efforts to inform applicants of major changes.
Surface representations; Geometry Registration:
- Local and global registration (ICP, branch-and-bound);
- Geometry Acquisition;
- 3D acquisition using laser scanners;
- Structure from motion-based acquisition;
Differential Geometry:
- Introduction to curves and surface;
- Introduction to curves and surface;
- Mesh Smoothing and Decimation;
- Parametrization and Remeshing;
- Mesh Deformation;
- Laplace Beltrami Operator;
- Shape Analysis;
- Shape Synthesis;
- ML in the context of geometry processing

Requisites:
In order to be eligible to select this module, a student must be registered on a programme for which it is a formally-approved option or elective choice AND should have (i) an understanding of linear algebra; and (ii) coding experience.
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