

Project Year

2003

Project Team

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Project Title

Interactive Modules for Metric Pattern Theory

Audience

Biomedical engineering students enrolled in Professor Miller's *Metric Theory* course and other related courses. The department also plans to share the modules with non-numerate neuroscientists in the field, along with students in mathematics, biology, mechanical engineering, and radiology at other universities.

Pedagogical Issue

The seminal ideas of metric pattern theory were outlined in biologist D'Arcy W. Thompson's classic, "On Growth and Form," in 1917. However, the field's foundations did not fully develop until the 1990s, when the area of computational anatomy was created by Professor Grenander at Brown University and Professor Miller at Johns Hopkins University. The fields of computational anatomy and metric pattern theory are emerging ones, and have far-reaching applications in biology and healthcare. Metric pattern theory combines several fields of mathematics -- algebra, geometry, and probability -- to define the probability of the metric distance between two objects. This metric distance represents the transformation of one object into another one with one number. The advanced mathematical concepts are difficult to comprehend, and visual representations would greatly aid students in understanding the subject.

Solution

The project team proposes to develop six web-based modules, designed to improve students' graphic and visual intuitions in understanding metric pattern theory. These modules cover six introductory topics: group theory, deformable templates, template matching, matrix groups, lie groups, and group actions and orbits. The modules use real-world examples, and contain background information and visual simulations that represent each topic's mathematical algorithms.

Technologies Used

Courseware (WebCT development), JAVA, Mathright, OpenGL, ActiveX

A link to the Introduction to Metric Pattern Theory site is available here:

<http://www.cis.jhu.edu/education/introPatternTheory/>