Visual Computing Minor
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The goal of this proposal is to introduce a new CTI minor in the area of Visual Computing. The proposal does not introduce any new courses in the CTI curriculum and it will help many CTI and MATH students taking the proposed sequence of courses to get a minor in Visual Computing. Many of these students are currently doing research in the Visual Computing area at CTI, are authors/co-authors of research publications, and had summer research assistantships/internships in different Visual Computing laboratories at CTI and other universities. The combination of the courses proposed for this minor, the participation in the weekly VC seminar, and the involvement in solving real-world problems (Medical Imaging with Northwestern Memorial Hospital, Image Processing with Accenture Technology Labs) can foster excellent students in the Visual Computing area and increase student retention for graduate studies.

List of proposed courses for the VC minor:

MAT140: Discrete Mathematics I or MAT 220 or One quarter of Calculus (CSC 381 requirement)
IT223 (required for CSC367): Data Analysis
CSC381: Introduction to Image Processing
CSC382: Image Analysis and its Applications
CSC384: Introduction to Computer Vision
CSC367: Introduction to Data Mining (IT223 requirement)

Courses’ descriptions:

MAT 140: Discrete Mathematics I

The logic of compound statements, application to digital logic circuits and computer arithmetic, the logic of predicates and quantified statements, programming logic, elementary number theory and methods of proof, sequences and mathematical induction, algorithms, combinatorial reasoning, the binomial theorem. PREREQUISITE(S): MAT 130 or placement by the Mathematics Diagnostic Test.

MAT 220: Linear Algebra with Applications

(Primarily for non-mathematics majors.) Systems of linear equations, matrices and matrix algebra, determinants, applications to linear programming, graph theory, etc. PREREQUISITE(S): MAT 141 or 151 or 161

IT 223: Data Analysis: Application of statistical concepts and techniques to a variety of problems in IT areas and other disciplines, using a statistical package for simple data analysis. Course topics include descriptive statistics, elementary probability rules, sampling, distributions,
confidence intervals, correlation, regression and hypothesis testing. Prerequisites: MAT 130 or placement

**CSC 381: Introduction to Image Processing:** Components of an image processing system and its applications, elements of visual perception, sampling and quantization, image enhancement by histogram equalization, color spaces and transformations, introduction to segmentation (edge detection algorithms), and morphological image processing. Prerequisites: MAT 140 or MAT 220 or Calculus.

**CSC 382: Image Analysis and its Applications:** The course is meant to provide students with the basic techniques of image analysis and understanding required for the medical domain, military domain, new and emerging domains, and other fields of interest to the students. The topics covered in the course include: imaging modalities, 2D & 3D imaging, 2D & time-sequence images, archiving, accessing and transmitting large images, optic flow, increased visual discrimination, segmentation, registration, diagnosis, feature extraction, and image visualization. Prerequisites: CSC 381.

**CSC 384: Introduction to Computer Vision:** Edge detection. Image representation and description using low-level features. A sample of image segmentation techniques. Perceptual grouping, 2D shape representation and classification. Motion analysis and tracking. Prerequisites: CSC 381.

**CSC 367: Introduction to Data Mining:** The course is an introduction to the Data Mining (DM) stages and its methodologies. The course provides students with an overview of the relationship between data warehousing and DM, and also covers the differences between database query tools and DM. Possible DM methodologies to be covered in the course include: multiple linear regression, clustering, k-nearest neighbor, decision trees, and multidimensional scaling. These methodologies will be augmented with real world examples from different domains such as marketing, e-commerce, and information systems. If time permits, additional topics may include privacy and security issues in data mining. The emphasis of this course is on methodologies and applications, not on their mathematical foundations. Prerequisites: IT 223.