

CIS 515: Fundamentals of Linear Algebra and Optimization

Credit: 1 course unit, elective course

Catalog Description:

This course provides firm foundations in linear algebra and basic optimization techniques. Emphasis is placed on teaching methods and tools that are widely used in various areas of computer science. Both theoretical and algorithmic aspects will be discussed.

Prerequisites:

Undergraduate course in linear algebra, calculus

Textbook(s) and/or other Required Materials:

1. Numerical Linear Algebra, by L. Trefethen and D. Bau, SIAM, 1997 (Parts of Chapters I, II, IV and V)
2. Applied Numerical Linear Algebra, by J. Demmel, SIAM, 1997 (Parts of Chapters I, II, III, IV and V)
3. Matrix Computations, by G.H. Golub and C.F. Van Loan, SIAM, 1996 (General reference on Numerical Linear Algebra)

Course Goals:

The goal of this course is to provide firm foundations in linear algebra and optimization techniques that will enable students to analyze and solve problems arising in various areas of computer science, especially computer vision, robotics, machine learning, computer graphics, embedded systems, and market engineering and systems. The students will acquire a firm theoretical knowledge of these concepts and tools. They will also learn how to use these tools in practice by tackling various judiciously chosen projects (from computer vision, etc.). This course will serve as a basis to more advanced courses in computer vision, convex optimization, machine learning, robotics, computer graphics, embedded systems, and market engineering and systems.

Topics Covered:

Fundamentals of linear algebra: Basic concepts; solving linear systems; eigenvalues and eigenvectors; singular value decomposition, pseudo-inverses, PCA. Basics of optimization: review of analysis (derivatives, gradient, Hessian, Lagrange multipliers). Basics of quadratic optimization; the Rayleigh-Ritz ratio. Basics of Linear Programming; duality and the Farkas lemma.

Class Laboratory Schedule: Lecture: 6 hr/week in summer or 3/hr week in spring

Expected first course offering: summer session I 2011 or spring 2012

Contribution towards Program Outcomes:

Multidisciplinary Ability	High	Experimentation	High
Problem Solving Approach	High	Professional Orientation	High
Problem Solving Methods	High		

Person(s) Preparing Description and Date:

Jean Gallier 2/4/11 – see attached for original