UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Approximation Methods and Models

2223-1-F4001Q081

Aims

In line with the educational objectives of the Degree in Mathematics, the course aims to introduce and to study methods for approximating data both from a theoretical and a practical point of view.

The expected learning outcomes include:

Knowledge

- Knowledge and understanding of the fundamental definitions and statements, as well as the proofs of cruciual theorems.
- Knowledge and understanding of issues that intervene in this field and know how to identify the most appropriate methodology in relation to the situations addressed.

Abilitity

- Ability to translate the theory studied in concrete examples through the construction of algorithms and their implementation.
- Ability to choose the most appropriate numerical method inrelation to the proposed problem.
- Ability to critically analyse the results of the proposed examples and exercises and know how to recognize and analyse the problems that arise in the light of the theory studied.
- Ability to expose, communicate and argue in a clear andprecise way both the theoretical contents of the course andtheir applications to specific situations.

Contents

Classical approximation techniques in dimension one. Multivariate approximation, kernel and mesh-free methods

Detailed program

Interpolation and least square approximation in dimension one.

Multivariate approximation

Scattered data interpolation

Radial basis functions

Positive definite radial functions

Scattered data interpolation with polynomial precision

Conditionally positive definite radial functions

Interpolation error estimate

Stability and conditioning of radial basis function interpolation

Algorithms

Partition of unity methods

Least squares approximation via radial basis functions

Prerequisites

Fundamental courses of the bachelor degree in Mathematics: Basic knowledge of Linear Algebra, Analysis, Numerical Analysis, and Matlab.

Teaching form

Frontal lectures illustrating definitions,results technical demonstrations and examples relevant to the issues addressed. Some of the lessons will be devoted to the implementation of the algorithms that will be used to apply to practical examples as studied from the theoretical point of view.

Textbook and teaching resource

Gregory E. Fasshauer: Meshfree Approximation Methods with Matlab, World Scientific

Holger Wendland: Scattered data approximation, Cambridge Press

e-learning page of the course

Recorded lessons

Semester

I

Assessment method

The exam is oral and consists of

- A presentation by the student of a project assigned during the course to test the acquisition of the expected skills. The project can also be developed within a working group.
- Questions about the theory presented in the course that aim to verify the knowledge of the proposed themes, and the ability to critically review the definitions, statements, demonstrations and numerical issues presented during the course.

The two parties equally contribute to the determination of the final grade.

Mark range 18-30/30

Office hours

by appointment (please write to milvia.rossini@unimib.it).

Sustainable Development Goals

QUALITY EDUCATION