Introduction to Numerical Methods

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Introduction & Course Overview

Matlab -Matrix Laboratory

Currently Matlab is available on SYSU Network

MatLab

The Matlab program can be run using command line, batch commands, and programs.

What is a program?

Program consist of three main components:

- Input
- Main Program - Numerical methods and analysis and/or evaluation.
- Output - Results.

Inputs

- Numerical values
- Initialization of the variables
- Conditions
- Equations

Main Program

Using flow charts, the programs can be designed to perform a task. Using:

- Loops   (for do while)
- Conditions (if then elseif etc..)
- Error Convergence (while)

Output

Outputs are the results of the program. They can go through a series of post-processing methods.

- Numerical Values
- Decisions
- Graphs and Plots

MatLab

Variable Types

- Integers
- Real Values (float and double, <u>vpa</u>)
- Complex Numbers (a + ib)
    - a - real value
    - b - imaginary value ("i" is the square root of -1)

Matlab

Data types

- Numerical
  - Scalars
  - Vectors
  - Matrices
- Logic Types

Matlab

- A scalar value is the simple number, a, 2, 3.14157…,

- A vector is a union of scalars

$$x = [x_1, x_2, x_3, x_4]$$

- Transpose vector

$$x^{\mathrm{T}} = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$$

Matlab

- Matrix is a combination of vectors and scalars. Scalar and vectors are subsets of matrices.

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$$

- Matlab uses matrix to do mathematical methods.

- A=[a11 a12 a13; a21 a22 a23; a31 a32 a33];

Matlab

- Set of computer functions
  - Trigonometric functions - sin(x),cos(x), tan(x), asin(x), acos(x), atan(x)
  - Hyperbolic functions - sinh(x), cosh(x), tanh(x)
  - Logarithmic functions - ln(x), log(x), exp(x)
  - Complex functions - abs(x), real(x), imag(x)

Matlab

- Simple commands
  - clc   - clears command window
  - clg   - clear graphic window
  - clear   - clears the workspace
  - who   - variable list
  - whos   - variable list with size
  - help   - when doubt use it!

Matlab

- Simple commands and symbols
  - ^C   - an escape from a loop
  - inf   - infinity
  - NaN   - No numerical value

>> 1/0=Inf

>> -1/0=-Inf

>> 0/0=NaN

Matlab - Scalar Operations

- Addition   -   a + b
- Subtraction   -   a - b
- Multiplication   -   a * b
- Division   -   a / b
- Exponential   -   a^b

Matlab - Vector Operations

Matlab - Matrix Operations

Order of Precedence of Arithmetic Operations

Precedence

    (1)   - Parenthesis -- (help [)

    (2)   - Exponential from left to right

    (3)   - Multiplication and division from left to right.

    (4)   - Addition and subtraction from left to right.

ZYN books:

[13] 张雨浓, 杨逸文, 李巍, 神经网络权值直接确定法, 中山大学出版社, 2010年11月

[12] 张雨浓, 蔡炳煌（编）, 人工神经网络研究进展及论文发表过程论辩, 电子工业出版社, 2010年6月

[7] 邹阿金, 张雨浓, 基函数神经网络及应用, 中山大学出版社, 2009年4月

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人工神经网络研究进展及论文发表过程 论辩

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内容简介

　　科学成果的取得不是简单的闭门造车，而是要在实践和辩论中去检验；苏格拉底讲，真理是论辩而得。本书阐述了作者及团队最新的人工神经网络学术研究成果及其论文投稿与论辩过程，阐明了科学研究中论辩的重要性、丰富意义和对后续科研思路的启发。本书可使读者在了解和学习人工神经网络最新科研成果的同时，协助和加快读者进入相关科学研究之门径，为读者研究成果的发表提供指导和参考。本书可作为相关学科的教材和科研用书。
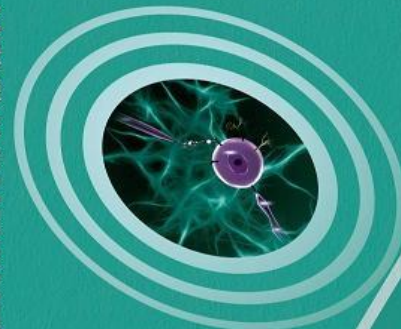
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- Using this group of PPTs, please read

- [1] Yunong Zhang, Weimu Ma, Xiao-Dong Li, Hong-Zhou Tan, Ke Chen, MATLAB Simulink modeling and simulation of LVI-based primal-dual neural network for solving linear and quadratic programs, Neurocomputing 72 (2009) 1679-1687

- [2] Yunong Zhang, Chenfu Yi, Weimu Ma, Simulation and verification of Zhang neural network for online time-varying matrix inversion, Simulation Modelling Practice and Theory 17 (2009) 1603-1617