9	Bayesian probabilistic inference, Bayesian networks, Dempster-Shafer theory, Introduction to fuzzy sets and fuzzy logic.
10	Basic reasoning using fuzzy concepts, production rules, Chomsky hierarchy of grammars, context-free grammars.
11	Hill climbing and its variations, best first search.
12	A* algorithm, constraint satisfaction problem, means-end analysis.
13	Introduction to game playing, min-max procedure, alpha-beta pruning.
14-15	Overview of linguistics, Chomsky hierarchy of grammars, parsing techniques..

Assessment Methods

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

Keywords

Artificial Intelligence, Problem Solving, Knowledge Representation, Reasoning, Uncertainty, Natural Language Processing

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Computer Graphics (BHCS14) Discipline Specific Core Course - (DSC)

Credit: 06

Course Objective

This course introduces fundamental concepts of Computer Graphics with focus on modelling, rendering and interaction aspects of computer graphics. The course emphasizes the basic principles needed to design, use and understand computer graphics system.

Course Learning Outcomes

On successful completion of the course, students will be able to:

1. Describe Standard raster and vector scan devices as well as Graphical Input and output devices
2. Implement algorithms for drawing basic primitives such as linecircle and ellipse.
3. Implement algorithms for line clipping and polygon clipping and filling.

4. Implement a 3D object representation scheme and carryout 2D and 3D Transformation, 3D projections

5. Implement visible surface determination algorithms, Illumination models and surface rendering methods, color models

6. Implement a simple computer animation algorithm

Detailed Syllabus

Unit 1

Introduction: Introduction to Graphics systems, Basic elements of Computer graphics, Applications of computer graphics. Architecture of Raster and Random scan display devices, input/output devices.

Unit 2

Drawing and clipping primitives: Raster scan line, circle and ellipse drawing algorithms, Polygon filling, line clipping and polygon clipping algorithms

Unit 3

Transformation and Viewing: 2D and 3D Geometric Transformations, 2D and 3D Viewing Transformations (Projections- Parallel and Perspective), Vanishing points.

Unit 4

Geometric Modeling: Polygon Mesh Representation, Cubic Polynomial curves (Hermite and Bezier).

Unit 5

Visible Surface determination and Surface Rendering: Z-buffer algorithm, List-priority algorithm and area subdivision algorithm for visible surface determination. Illumination and shading models, RGB color model and Basics of Computer Animation.

Practical

1. Write a program to implement Bresenham's line drawing algorithm.

2. Write a program to implement mid-point circle drawing algorithm.

3. Write a program to clip a line using Cohen and Sutherland line clipping algorithm.

4. Write a program to clip a polygon using Sutherland Hodgeman algorithm.

5. Write a program to fill a polygon using Scan line fill algorithm.

6. Write a program to apply various 2D transformations on a 2D object (use homogenous

Coordinates).

7. Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.

8. Write a program to draw Hermite /Bezier curve.

References

1. Baker, D.H. (2008). *Computer Graphics.* 2nd edition. Prentice Hall of India.

2. Foley, J. D., Dam, A.V, Feiner, S. K., & Hughes, J. F. (1995). *Computer Graphics: Principles and Practice in C.* 2nd edition. Addison-Wesley Professional.

Additional Resources:

1. Bhattacharya, S. (2018). *Computer Graphics*. Oxford University Press

2. Cohen, D. I. A. (2011). *Introduction to Computer Theory*. 2nd edition. Wiley India.

3. Marschner, S., & Shirley, P. (2017) *Fundamentals of Computer Graphics*. 4th edition. CRC Press

4. Rogers, D. F. (1989). *Mathematical Elements for Computer Graphics*. 2nd edition. McGraw Hill.

Course Teaching Learning Process

- Use of ICT tools in conjunction with traditional class room teaching methods
- Interactive sessions
- Class discussions

Tentative weekly teaching plan is as follows:

Week	Contents
1	Introduction to Graphics systems, Basic elements of Computer graphics, Applications of computer graphics.
2	Graphics Hardware: Architecture of Raster and Random scan display devices, input/output devices.
3-4	Drawing Primitives: Raster scan line drawing algorithm, circle and ellipse drawing algorithms
5	Polygon filling, line clipping and polygon clipping algorithms
6	Transformation: 2D and 3D Geometric Transformations
7-9	Viewing : 3D Viewing Transformations, Parallel Projections, Perspective Projections ,Vanishing points
10	Geometric Modeling: Representing curves(Hermite and Bezier)
11-12	Geometric Modeling: Representing curves(Hermite and Bezier)(cont.), Visible Surface determination: Z-buffer algorithm
13	List-priority algorithm and area subdivision algorithm.
14	Surface rendering: Illumination and shading models
15	RGB color model and Computer Animation.

Assessment Methods

Written tests, assignments, quizzes, presentations as announced by the instructor in the class.

Keywords

Computer Graphics, Modelling, Rendering, Transformation and viewing

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Data Analysis and Visualization (BHCS15A) Discipline Specific Elective - (DSE)

Credit: 06

Course Objective

This course introduces students to data analysis and visualization in the field of exploratory data science using Python.

Course Learning Outcomes

On successful completion of the course, the students will be able to :

1. Use data analysis tools in the pandas library.
2. Load, clean, transform, merge and reshape data.
3. Create informative visualization and summarize data sets.
4. Analyze and manipulate time series data.
5. Solve real world data analysis problems.

Detailed Syllabus

Unit 1

Introduction: Introduction to Data Science, Exploratory Data Analysis and Data Science Process. Motivation for using Python for Data Analysis, Introduction of Python shell iPython and Jupyter Notebook.

Essential Python Libraries: NumPy, pandas, matplotlib, SciPy, scikit-learn, statsmodels

Unit 2

Getting Started with Pandas: Arrays and vectorized conputation, Introduction to pandas Data Structures, Essential Functionality, Summarizing and Computing Descriptive Statistics.

Data Loading, Storage and File Formats.

Reading and Writing Data in Text Format, Web Scraping, Binary Data Formats, Interacting with Web APIs, Interacting with Databases

Data Cleaning and Preparation.

Handling Missing Data, Data Transformation, String Manipulation

Unit 3

Data Wrangling: Hierarchical Indexing, Combining and Merging Data Sets Reshaping and Pivoting.

Data Visualization matplotlib: Basics of matplotlib, plotting with pandas and seaborn, other python visualization tools

Unit 4

Data Aggregation and Group operations: Group by Mechanics, Data aggregation, General split-apply-combine, Pivot tables and cross tabulation