Department of Computer Science and Engineering

Digital Image Processing

2150601

COURSE OBJECTIVES:

1. To understand the fundamentals of image acquisition, image processing in spatial and frequency domain.
2. To understand image transforms used in digital image processing.
3. To know about the image restoration techniques and methods used in image processing.

Unit I Introduction and Fundamentals

Introduction to Image Processing Systems, Digital Image fundamentals: Components of Digital Image Processing Systems, Image Model, Image Geometry, Sampling and Quantization of Images, Classification of Digital Images, Zooming and Shrinking, Relationship between pixels.

Unit II Image Enhancement in Spatial Domain

Introduction, Basic Gray Level Function, Piecewise Linear

Transformation, Contrast Stretching, Histogram Specification, Histogram Equalization, Local Enhancement using arithmetic and logical operation- Image Subtraction, Image averaging, Image Smoothing: Smoothing Spatial Filters, Smoothing Linear Filters, Image Sharpening.

Unit III Image Enhancement in Frequency Domain:

Introduction to Fourier Transform, Filters: Low Pass and High Pass, Gaussian Filters, Homomorphic Filtering, Image Restoration: Model of Image Degradation/Restoration process, Noise Models, Noise Reduction in Spatial and Frequency Domain, Inverse Filtering, Mean Filters, Least Mean Square (Wiener) Filtering, FIR Wiener Filter.

Unit IV Morphological Image Processing

Logic operation involving binary images, Dilation and Erosion, Opening and Closing, Morphological Algorithms: Boundary Extraction, Region filling, Extraction of connected components, Convex Hull, Thinning and Thickening.

Unit V Image Registration: Introduction, Geometric Transformation, Plane to plane Transformation, Mapping,

Image Segmentation: Introduction, Region Extraction, Pixel based approach, Multilevel Thresholding, Local Thresholding, Region based approach, Geometric Transformation Optimization for High-Resolution Image Registratio, Multi-Thresholding and Region-Growing Algorithms for Complex Image Segmentation

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RECOMMENDED BOOKS

1. Digital Image Processing 2nd Edition, Rafael C. Gonzalvez and Richard E. Woods. Published by: Pearson Education.

2. Digital Image Processing and Computer Vision, R.J. Schalkoff. Published by: John Wiley and Sons.

3. Fundamentals of Digital Image Processing, A.K. Jain. Published by Prentice Hall

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COURSE OUTCOMES

After completion of the course students would be able to:

CO1: **Describe** the fundamental concepts of digital image processing
CO2: **Apply** techniques for spatial domain image enhancement
CO3: **Analyze** frequency domain methods for image enhancement and restoration
CO4: **Evaluate** morphological image processing techniques, such as dilation, erosion, and algorithms for region filling, boundary extraction, and thinning.
CO5: **Develop** and implement methods for image segmentation and registration

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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2		1	2		3			1	3	1	3	2	2
CO2	3	2	1	2		3			2		2	3	2	3
CO3	3	3	2			3			3			3	2	3
CO4	2	3	2	2		3			2		2	3	2	2
CO5	3	2	2			3		1	2		2	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Department of Computer Science and Engineering

Digital Image Processing

2150601

LIST OF EXPERIMENT

1. Program to read an image and display it on the screen.
2. Program to determine image negative.
3. Read an image and perform different filtering operations (Average, Median etc.)
4. Program to create motion blur.
5. Program performs gray level slicing without background.
6. Program to perform brightness enhancement and brightness suppression of an image.
7. To create a vision program to find histogram value and display histograph of a grayscale and color image.
8. Read an RGB image and segment it using threshold method.
9. Read a colour image and separate the colour image into red green and blue planes.
10. Perform gamma correction for the given colour image
11. Program to perform different image conversion techniques
12. To create a color image and perform read and write operation
13. Code to implement watermarking in spatial domain.
14. Code to generate different levels of Gaussian Pyramid.

Department of Computer Science and Engineering

Digital Image Processing

2150601

List of Skill Based Mini Project

1. Read multiple images from a folder and show them using sub plotting operation.
2. Read an image given by the user and perform different filtering operations (Average, Median etc.)
3. Implement Smart selfie using image processing techniques.
4. Object detection (eg. Face mask, Number plate etc.)
5. Bookshop management system using Image processing techniques
6. Real time sentiment analysis.
7. Apply image segmentation techniques on original image given by the user.
8. Implement a GUI to enhance the image using Histogram equalization techniques.
9. Implement a GUI for Edge detection (Sobel, Prewitt, Canny etc.)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Digital Image Processing

2150616 (OLD)

COURSE OBJECTIVES:

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2. To understand image transforms used in digital image processing.
3. To know about the image restoration techniques and methods used in image processing.

Unit – I:

Introduction and Fundamental: Introduction to Image Processing Systems, Digital Image fundamentals: Components of Digital Image Processing Systems, Image Model, Image Geometry, Sampling and Quantization of Images, Classification of Digital Images, Zooming and Shrinking, Relationship between pixels.

Unit – II:

Image Enhancement in spatial Domain: Introduction, Basic Gray Level Function, Piecewise Linear Transformation, Contrast Stretching, Histogram Specification, Histogram Equalization, Local Enhancement using arithmetic and logical operation- Image Subtraction, Image averaging, Image Smoothing: Smoothing Spatial Filters, Smoothing Linear Filters, Image Sharpening.

Unit – III:

Image Enhancement in Frequency Domain: Introduction to Fourier Transform, Filters: Low Pass and High Pass, Gaussian Filters, Homomorphic Filtering, **Image Restoration:** Model of Image Degradation/Restoration process, Noise Models, Noise Reduction in Spatial and Frequency Domain, Inverse Filtering, Mean Filters, Least Mean Square (Wiener) Filtering, FIR Wiener Filter.

Unit – IV:

Morphological Image Processing: Logic operation involving binary images, Dilation and Erosion, Opening and Closing, Morphological Algorithms: Boundary Extraction, Region filling, Extraction of connected components, Convex Hull, Thinning and Thickening.

Unit –V:

Image Registration: Introduction, Geometric Transformation, Plane to plane Transformation, Mapping, **Image Segmentation:** Introduction, Region Extraction, Pixel based approach, Multilevel Thresholding, Local Thresholding, Region based approach, Region growing, Splitting and Merging, Edge and line detection, Corner Detection, Detection of Discontinuities, Edge and boundary detection.

RECOMMENDED BOOKS:

1. Digital Image processing, Rafael C Gonzalez, Richard E Woods, Pearson Education.
2. Fundamental of Digital Image processing, K. Jain, Pearson education.
3. Digital Image Processing, S. Esakkirajan, S. Jayaraman, T. Veerakumar, Tata McGraw- Hill Education

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COURSE OUTCOMES: After completing the course, the student will be able to:

CO1: Explain different modalities and current techniques in image acquisition.

CO2: Classify spatial and frequency domain techniques used in image processing.

CO3: Apply image processing techniques to enhance visual images

CO4: Analyze the constraints in image processing when dealing with real problems.

CO5: Evaluate various enhancement, restoration and retrieval techniques of image processing.

CO6: Design a system using the mathematical models and principles of digital image processing for real world problem

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Machine Learning

2150602

COURSE OBJECTIVES:

1. To understand types of issues and challenges that could be solved by machine learning.
2. To be able to understand wide variety of learning models and use them.
3. To be able to evaluate and optimize these models

Unit – I:

Introduction to Machine Learning: Learning, Traditional Vs Machine Learning, Types Of ML, Classification and Regression model, Challenges faced by ML, Steps of developing an ML model, Bias and Variance, Underfitting and Overfitting, Regularization, Data visualization, Outlier, Testing and validating, K cross validation, Hyperparameter tuning, Model Selection.

Unit – II:

Model optimization and Evaluation: Parametric and non- Parametric model, Learner performance evaluation, confusion matrix, Recall, accuracy, precision, Model optimization, Cost/Loss Function, Derivative of cost function and non-derivative cost function, Gradient descent, Mini-batch Gradient Descent (sckit-learn), Stochastic Gradient descent(sckit-learn), Momentum(sckit-learn).

Unit – III:

Supervised Machine Learning Algorithim with python: Model Complexity vs Dataset Size, Supervised Machine Learning Algorithms, k-Nearest Neighbors, Linear Regression, RMSE, Logistic Regression, Log Loss**,** Support Vector Machine, Hinge Loss, Kernel Trick, polynomial Kernal, Decision Trees, Gini impurity.

Unit – IV:

Ensemble Learner with python: Ensemble learner, Bagging, Pasting , Voting Classifiers, Out-of-Bag, Evaluation, Random Patches and Random Subspaces , Random Forests , Extra-Trees, Boosting , AdaBoost, Gradient Boosting, Stacking.

Unit –V:

Unsupervised Machine Learning with python: The Curse of Dimensionality, Principal component analysis, Clustering , K-Means, Limits of K-Means,Clustering, DBSCAN. **ElasticNet, Transformer-based models, Explainable ML, Ethical ML, AutoML,, Capstone Project and Case Studies: Build an end-to-end supervised or unsupervised ML pipeline.**

RECOMMENDED BOOKS:

1. Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow by Aurélien Géron
2. Introduction to Machine Learning with Python by Andreas C. Müller & Sarah Guido, O'reilly
3. Machine Learning For Absolute Beginners: A Plain English Introduction (Second Edition)" by Oliver Theobald
4. Machine Learning For Dummies" by John Paul Mueller and Luca Massaron
5. Machine Learning in Action" by Peter Harrington

COURSE OUTCOMES: After completing the course, the student will be able to:

CO1: Define basic concepts of Machine Learning.

CO2: Illustrate various techniques for learner evaluation and optimization using python

CO3: Implement various types of supervised machine learning algorithm using python

CO4: Apply ML ensemble model to solve real world problem using python

CO5: Apply unsupervised ML techniques to solve real world problems using python

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CO4	3	2	2	2	3	1	-	-	1	1	2	3	3	3
CO5	2	2	3	3	3	1	-	-	2	3	3	3	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Machine Learning

2150602

LIST OF EXPERIMENT

1. Perform exploratory data analysis and visualization after importing a .CSV file.
   - ☐ Handle missing data by detecting and dropping/ filling missing values.
   - ☐ Transform data using different methods.
   - ☐ Detect and filter outliers.
   - ☐ Perform Vectorized String operations on Pandas Series.
   - ☐ Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.
2. Recognize data Skew-ness, outliers both using statistical function and Graphical representation.
3. Write a Python program to implement Simple Linear Regression to predict if male or female based on Height.
4. Implement Various Regression algorithm for House Price Prediction (USA housing Dataset) and compare their accuracy using scikit learn
   - ☐ Linear Regression
   - ☐ Polynomial Regression
   - ☐ Support Vector machine
5. Implement Logistic regression using softmax on iris dataset using scikit learn.
6. Implement Regularized Regression for house price prediction and evaluate their accuracy using scikit learn.
   - ☐ Ridge Regression
   - ☐ Lasso Regression
7. Implement Various Classification algorithms for iris data sets and evaluate their performance.
   - ☐ Naive Bayes Classifier
   - ☐ Logistic Regression
   - ☐ Support vector Machine
   - ☐ Decision tree
8. Implement Various ensemble on housing and iris dataset and evaluate their performance
   - ☐ Voting classifier
   - ☐ Random Forest (Bagging and pasting)
9. Implement principle component analysis on any chosen dataset/
10. Implement various clustering algorithm on chosen dataset

1. K-Mean

2. DBSCAN

Machine Learning

2150602

List of Skill Based Mini Project

1. Implement a regressor for any Medical disease diagnosis.
2. Implement a Cervical Cancer Risk Classifier
3. Regression model for Video Game Sales Prediction
4. Regression model for predicting if song will be popular
5. Regression model for Customer Behavior Analysis
6. Regression model to predict health insurance cost
7. Titanic Survival Prediction
8. Spam and not Spam Classifier
9. Spotify Music Recommendation System
10. Target Customer segmentation.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Machine Learning

150617(OLD)

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