RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

CSE-IOT/IOT, VIII-Semester

IO 801 –Artificial Intelligence

Unit –I Introduction to machine learning neural network- Biological Neuron, Artificial Neuron-McCulloch-Pitts Neuron, Rosenblatt Perceptron, Perceptron learning algorithm, The XOR problem.

Unit –II Artificial Neural network-Input, hidden, and output layers, Activation Functions-sigmoid, tanh, ReLU, PReLU, Linear activation. Loss Functions- MSE, MAE, Cross-Entropy, Gradient Descent, momentum, Back propagation algorithm, Weights and bias in ANN, Weight initialization, Training, Testing and Validation, L1 and L2 regularization, Dropout, tuning hyper parameters.

Unit –III Convolutional neural network, Flattening, Padding and stride, Types of CNN layers: convolution layer, pooling layer, activation layer, Deconv layer.Transfer Learning, Dropout, Inception.Different performance metrics – Accuracy, Recall, precision, F1-score. Confusion Matrix.

Unit –IV: Recurrent Neural Networks- Sequence learning with neural nets, unrolling the recurrence, training RNN- Back propagation through time (BPTT), vanishing gradient problem, Gated recurrent unit (GRU), Long short-term memory (LSTM), Bidirectional LSTMs, bidirectional RNNs.

Unit –V: Architecture of Alex Net, VGG-16, Resnet, GoogLeNet, Case Study: MNIST data set, Image Net Competition

Textbooks:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning" 2015, MIT Press

2. Josh Patterson and Adam Gibson, “Deep Learning- A Practitioner’s Approach” O’Reilly Media Inc., 2017, USA.

3. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2011

4. Tom M. Mitchell, “Machine Learning”, McGraw Hill Education, First edition, 2017.

REFERENCE BOOKS:

1. Aurelien Geon, “Hands-On Machine Learning with Scikit-Learn and Tensorflow:

Concepts, Tools, and Techniques to Build Intelligent Systems”, Shroff/O'Reilly; First edition (2017).

2. Francois Chollet, "Deep Learning with Python", Manning Publications, 1 edition (10 January 2018).

3. Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data

Scientists", Shroff/O'Reilly; First edition (2016).

4. Russell, S. and Norvig, N. “Artificial Intelligence: A Modern Approach”, Prentice Hall Series in Artificial Intelligence. 2003

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CSE-IOT/IOT, VIII-Semester

Departmental Elective – IO802 (A) IoT Applications

Unit I: Definition, IoT v IIoT, Next Generation Sensors, Sensor's calibration andvalidate sensor measurements, Use of IoT devices in equipments, sensors, low-costcommunication system design, Top application areas include manufacturing, oil & gas, Networking and wireless communication protocols used in IIoT deployments.

Unit II: Introduction to robots, Robot control system architecture; Introduction to cloud-enabled robotics; Applications of IIoT in robotics; Architectures for IoRT, Examples and case studies: Open issues and challenges.

Unit III: Internet of Medical Things Introduction and system architecture: Introduction, IoMT Devices-On-Body Devices, In Home Devices, Community Devices, In-Clinic Devices, In Hospital Devices, IoMT System Architecture-Data Collection Layer, Data Management Layer, Medical Server Layer

Unit IV: Internet of Medical Things Security Threats, Security Challenges and Potential Solutions: IoMT Attack Types, Challenges in IoMT Security Schemes, Current Security Plans for IoMT, Potential Solutions for Security Vulnerabilities.

Text Books

1. Veneri, Giacomo, and Antonio Capasso- Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure Using Industry 4.0, 1stEd., Packt Publishing Ltd, 2018.
2. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
3. Mittal R.K. and Nagrath I.J., "Robotics and Control", Tata McGraw Hill.
4. D. Jude Hemanth and J. Anitha George A. Tsihrintzis- Internet of Medical Things Remote Healthcare Systems and Applications, covered by Scopus
5. Alasdair Gilchrist- Industry 4.0: The Industrial Internet of Things, 1st Ed., Apress, 2017.
6. Reis, Catarina I., and Marisa da Silva Maximiano, eds.- Internet of Things and advanced application in Healthcare, 1st Ed., IGI Global, 2016

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CSE-IOT/IOT, VIII-Semester

Departmental Elective – IO802 (B) Emerging Areas in Blockchain

Course Objective:
Students will be able to:
1. Understand blockchain building blocks.
2. Familiar with Ethereum and Hyperledger.
3. Exploit applications of Blockchain in real world scenarios.

Course Outcomes:
1. Understand blockchain building blocks.
2. Explore the components DLT and Smart Contract.
3. Design and develop end-to-end decentralized applications.
4. Acquaint blockchain ecosystem.
5. Blockchain Ecosystem Services in real world sceneries.
6. Comprehend of emerging models.

UNIT I: Basic of Blockchain Architecture — Challenges — Applications — Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - peer-to-peer network — Abstract Models - GARAY model - RLA Model - Proof of Work (PoW) - Proof of Stake (PoS) based Chains -Hybrid models.

UNIT II: Distributed Ledger Technology: Origin of Ledgers, Features of DLT, Types of Distributed Ledger Technologies, Role of Consensus Mechanism, DLT Ecosystem, Distributed Ledger Implementations - Blockchain, Ethereum. Public and Private Ledgers - Registries, Ledgers, Practitioner Perspective: Keyless Technologies, Transparency as a Strategic Risk, Transparency as a Strategic Asset, Usage of Multiple IDs, Zero Knowledge Proofs, Implementation of Public and Private Blockchain.

UNIT III: Smart Contract: Anatomy of a Smart Contract, Life Cycle, Usage Patterns, DLT-based smart contracts, Use Cases: Healthcare Industry, Property Transfer.

UNIT IV: Decentralized Organizations 5 hours Decentralization versus Distribution, Centralized-distributed (Ce-Di) organizations, Decentralized-distributed (De-Di) organizations, Decentralized Autonomous Organizations, Aragon, DAOstack, DAOhouse and Colony.

UNIT V: Types of Blockchain Ecosystem One-Leader Ecosystem, Joint Venture or Consortia Ecosystems, Regulatory Blockchain Ecosystems, Components in Blockchain Ecosystem - Leaders, Core Group, Active Participants, Users, Third-Party Service Providers, Governance for Blockchain Ecosystems.

Refrences:
Text Book(s)
1 Dhillon, V., Metcalf, D., & Hooper, M. Blockchain enabled applications, 2017, CA: Apress, Berkeley.
2 Diedrich, H. Ethereum: Blockchains, digital assets, smart contracts, decentralized autonomous organizations. 2016, Wildfire publishing, Sydney.
3. Wattenhofer. R. P. Distributed Ledger Technology: The Science of the Blockchain. 2017. Inverted Forest Publishing.

Reference Books

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A.. & Goldfeder, S. Bitcoin and cryptocurrency technologies, Book Bitcoin and cryptocurrency technologies., 2016.
2. Baset. S. A., Desrosiers, L., Gaur, N., Novotny, P., O'Dowd, A., & Ramakrishna, V. Hands-on blockchain with Hyperledger: building decentralized applications with Hyperledger Fabric and composer. 2018, Packt Publishing Ltd.

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New Scheme Based On AICTE Flexible Curricula

CSE-IOT/IOT, VIII-Semester

Departmental Elective – IO802 (C) Big Data

Course Outcomes:

1. Students should be able to understand the concept and challenges of Big data.

2. Students should be able to demonstrate knowledge of big data analytics.

3. Students should be able to develop Big Data Solutions using Hadoop Eco System

4. Students should be able to gain hands-on experience on large-scale analytics tools.

5. Students should be able to analyse the social network graphs.

Course Content

Unit1: Introduction to Big data, Big data characteristics, Types of big data, Traditional versus Big data, Evolution of Big data, challenges with Big Data, Technologies available for Big Data, Infrastructure for Big data, Use of Data Analytics, Desired properties of Big Data system.

Unit2: Introduction to Hadoop, Core Hadoop components, Hadoop Eco system, Hive Physical Architecture, Hadoop limitations, RDBMS Versus Hadoop, Hadoop Distributed File system, Processing Data with Hadoop, Managing Resources and Application with Hadoop YARN, MapReduce programming.

Unit3: Introduction to Hive Hive Architecture, Hive Data types, Hive Query Language, Introduction to Pig, Anatomy of Pig, Pig on Hadoop, Use Case for Pig, ETL Processing, Data types in Pig running Pig, Execution model of Pig, Operators, functions,Data types of Pig.

Unit4: Introduction to NoSQL, NoSQL Business Drivers, NoSQL Data architectural patterns, Variations of NOSQL architectural patterns using NoSQL to Manage Big Data, Introduction to MangoDB

Unit5: Mining social Network Graphs: Introduction Applications of social Network mining, Social Networks as a Graph, Types of social Networks, Clustering of social Graphs Direct Discovery of communities in a social graph, Introduction to recommender system.

Text Books:

1. RadhaShankarmani, M. Vijaylakshmi, " Big Data Analytics", Wiley, Secondedition

2. Seema Acharya, SubhashiniChellappan, " Big Data and Analytics", Wiley, First edition

Reference Books:

1. KaiHwang,Geoffrey C., Fox. Jack, J. Dongarra, “Distributed and Cloud Computing”,

Elsevier, Firstedition

2. Michael Minelli, Michele Chambers, AmbigaDhiraj, “Big Data Big Analytics”,Wiley

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CSE-IOT/IOT, VIII-Semester

Departmental Elective – IO802 (D) Agile Software Development

Pre-Requisite: Software Engineering

Course Outcomes:
After completing the course student should be able to:
1. Describe the fundamental principles and practices associated with each of the agile development methods.
2. Compare agile software development model with traditional development models and identify the benefits and pitfalls.
3. Use techniques and skills to establish and mentor Agile Teams for effective software development.
4. Apply core values and principles of Agile Methods in software development.

Course Contents:
Unit-I: Fundamentals of Agile Process: Introduction and background, Agile Manifesto and Principles, Stakeholders and Challenges, Overview of Agile Development Models: Scrum, Extreme Programming, Feature Driven Development, Crystal, Kanban, and Lean Software Development.

Unit-II: Agile Projects: Planning for Agile Teams: Scrum Teams, XP Teams, General Agile Teams, Team Distribution; Agile Project Lifecycles: Typical Agile Project Lifecycles, Phase Activities, Product Vision, Release Planning: Creating the Product Backlog, User Stories, Prioritizing and Estimating, Creating the Release Plan; Monitoring and Adapting: Managing Risks and Issues, Retrospectives.

Unit-III: Introduction to Scrum: Agile Scrum Framework, Scrum Artifacts, Meetings, Activities and Roles, Scrum Team Simulation, Scrum Planning Principles, Product and Release Planning, Sprinting: Planning, Execution, Review and Retrospective; User story definition and Characteristics, Acceptance tests and Verifying stories, Burn down chart, Daily scrum, Scrum Case Study.

Unit-IV: Introduction to Extreme Programming (XP): XP Lifecycle, The XP Team, XP Concepts: Refactoring, Technical Debt, Timeboxing, Stories, Velocity; Adopting XP: Pre-requisites, Challenges; Applying XP: Thinking- Pair Programming, Collaborating, Release, Planning, Development; XP Case Study.

Unit-V: Agile Software Design and Development: Agile design practices, Role of design Principles, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control; Agility and Quality Assurance: Agile Interaction Design, Agile approach to Quality Assurance, Test Driven Development, Pair programming: Issues and Challenges.

Recommended Books:
1. Robert C. Martin, Agile Software Development- Principles, Patterns and Practices, Prentice Hall, 2013.
2. Kenneth S. Rubin, Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison Wesley, 2012.
3. James Shore and Shane Warden, The Art of Agile Development, O'Reilly Media, 2007.
4. Craig Larman, ―Agile and Iterative Development: A manager's Guide, Addison-Wesley, 2004.
5. Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson, 2001.
6. Cohn, Mike, Agile Estimating and Planning, Pearson Education, 2006.
7. Cohn, Mike, User Stories Applied: For Agile Software Development Addison Wisley, 2004.

Online Resources:

1. IEEE Transactions on Software Engineering
2. IEEE Transactions on Dependable and Secure Computing
3. IET Software
4. ACM Transactions on Software Engineering and Methodology (TOSEM)
5. ACM SIGSOFT Software Engineering Notes

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CSE-IOT/IOT, VIII-Semester

Open Elective – IO803 (A) Game Theory with Engineering applications

Theory :-

1. **Overview**: What is a Game, Game Design Schema, Game Design fundamentals, Engineering application of game theory, Design Process: Iterative design, Commissions, Design & Testing of the Board Game, Introduction to meaningful play, two kinds of meaningful play-discernible& integrated.

2. Introducing design, design & meaning, Semiotics: A brief overview, four semiotic Concepts, Context Shapes interpretations.

3. Introduction to Systems, elements of a System, Framing Systems, open & closed systems, Introduction to Interactivity, a multivalent model of interactivity, interaction & choice, choice molecules, anatomy of choice, space of possibility.

4. Defining games: overview of digital games, magic circle. Primary Schemas: conceptual framework, rule, play, culture.

5. Rules: defining rules, a deck of cards, quality of rules, rules in context, Rules on three levels: Operational, Constituative, Implicit, Identity of a Game, Specificity of Rules, Rules of Digital games. Case Studies: Tic Tac Toe, Deck of Cards.

TEXT BOOKS RECOMMENDED:-

1. Brathwaite, Brenda, and Ian Schreiber. Challenges for Game Designers: Non-digital Exercises for Video Game Designers. Boston, MA: Charles River Media/Course Technology, 2009. ISBN: 97815845058081
2. Game Design Workshop: A Playcentric Approach to Creating Innovative Games by Tracy Fullerton. ISBN-10: 1482217163.
3. Challenges for Game Designers by Brenda Brathwaite (now: Romero) and Ian Schreiber. ISBN-10: 158450580X

REFERENCE BOOKS:-

1. Rules of Play - Game Design Fundamentals, Katie Salen and Eric Zimmerman, The MIT Press Cambridge, Massachusetts London, England, book design and photography.

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CSE-IOT/IOT, VIII-Semester

Open Elective – IO803 (B) Image Processing and Computer Vision

Course Objectives: Students should be able to

- Understand practice and theory of computer vision.Elaborate computer vision algorithms, methods and concepts
- Implement computer vision systems with emphasis on applications and problem solving
- Apply skills for automatic analysis of digital images to construct representations ofphysical objects and scenes.
- Design and implement real-life problems using Image processing and computer vision.

Contents:

UNIT 1

Introduction to computer vision and Image processing (CVIP): Basics of CVIP, History of CVIP, Evolution of CVIP, CV Models, Image Filtering, Image Representations, Image Statistics Recognition Methodology: Conditioning, Labeling, Grouping, Extracting, and Matching, Morphological Image Processing: Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Morphological algorithm operations on binary images, Morphological algorithm operations on gray-scale images, Thinning, Thickening, Region growing, region shrinking.

UNIT 2

Image Representation and Description: Representation schemes, Boundary descriptors, Region descriptors Binary Machine Vision: Thresholding, Segmentation, Connected component labeling, Hierarchal segmentation, Spatialclustering, Split& merge, Rule-based Segmentation, Motion-based segmentation. Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting).

UNIT 3

Region Analysis: Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works For Matching: Distance relational approach, Ordered structural matching, View class matching, Models database organization

UNIT4

Facet Model Recognition: Labeling lines, Understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, Consisting labeling problem, Back-tracking AlgorithmPerspective Projective geometry, Inverse perspective Projection, Photogrammetric -from 2D to 3D, Image matching: Intensity matching of ID signals, Matching of 2D image, Hierarchical image matching. Object Models And Matching: 2D representation, Global vs. Local features

UNIT 5

Knowledge Based Vision: Knowledge representation, Control-strategies, Information Integration. Object recognition-Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, feature extraction, Neural network and Machine learning for image shape recognition

Reference Text

1. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, AddisonWesley, 1993

2. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach" Pearson

3. Milan Sonka,VaclavHlavac, Roger Boyle, "Image Processing, Analysis, and

Machine Vision" Thomson Learning.

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CSE-IOT/IOT, VIII-Semester

Open Elective – IO803 (C) Energy Harvesting Technologies and Power Management for IOT Devices

Course Objective: The objective of this course is to enable the students to understand the energy harvesting systems in IoT and use its knowledge various applications of IoT

Course Outcomes: After the completion of this course, the students will be able to:

1. Understand the energy harvesting systems in IoT
2. Apply strategies for enhancing the performance of energy harvesters
3. Learn various techniques of energy harvesting
4. Acquire knowledge of various power sources for wireless sensor networks
5. Build solutions for various applications by applying knowledge of case studies and examples

Unit I:

Energy Harvesting Systems: Introduction – Energy sources – energy harvesting based sensor networks – photovoltaic cell technologies – generation of electric power in semiconductor PV cells– types

Unit II

Piezo-Electric Energy Harvesting and Electromechanical Modeling: Piezoelectric materials – transducers – harvesters – micro generators – strategies for enhancing the performance of energy harvesters. Electromechanical modeling of Lumped parameter model and coupled distributed parameter models and closedform solutions

Unit III

Electromagnetic Energy Harvesting and Nonlinear Techniques: Basic principles – micro fabricated coils and magnetic materials – scaling – power maximations – micro and macro scale implementations. Non-linear techniques –vibration control & steady state cases

Unit IV

Energy Harvesting Wireless Sensors: Power sources for WSN – Power generation – conversion – examples – case studies. Harvesting microelectronic circuits – power conditioning and losses

Unit V

Case Study: Case studies for Implanted medical devices – Bio-MEMS based applications –harvesting for RF sensors and ID tags – powering wireless SHM sensor nodes

References:

1. Carlos Manuel Ferreira Carvalho, Nuno Filipe Silva Veríssimo Paulino, “CMOS Indoor Light Energy Harvesting System for Wireless Sensing Applications”, springer, 2016

2. Danick Briand, Eric Yeatman, Shad Roundy ,“Micro Energy Harvesting”, 2015

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CSE-IOT/IOT, VIII-Semester

Open Elective – IO803 (D) Managing Innovation and Entrepreneurship

COURSE OBJECTIVE

The aim of the course is to motivate students to innovate in business. In the first place, to achieve this goal, students will be introduced to the basic terminology, typology of innovations and historical context for better comprehension. Also issues of innovation management will be introduced. Students will become familiar with the impact of innovation, innovative processes and aspects that affect it, including applicable methods and innovation management techniques.

Course contents:

UNIT-1

Innovation, the basic definition and classification: The relationship of innovation and entrepreneurship, creation of competitive advantage based on innovation. Innovative models, Product, process, organizational and marketing innovation and their role in business development.

UNIT-II

Sources of innovation (push, pull, analogies), transfer of technology. Creative methods and approaches used in innovation management. Approaches to management of the innovation process (agile management, Six Thinking Hats, NUF test).

UNIT-III

Project approach to innovation management, method Stage Gate, its essence, adaptation of access to selected business models. In-house business development of the innovation process in the company. Open Innovation as a modern concept, the limits of this method and its benefits for business development.

UNIT-IV

Innovations aimed at humans, role of co-creation in the innovation process. The strategy of innovation process, types and selection of appropriate strategies.

UNIT-V

Measurement and evaluation of the benefits of innovation for business (financial and nonfinancial metrics, their combination and choice). Barriers to innovation in business, innovation failure and its causes, post-audits of innovative projects. Organization and facilitation of an innovation workshop.

REFERENCE BOOKS

1. CLARK, T. – OSTERWALDER, A. – PIGNEUR, Y. Business model generation: a handbook for visionaries, game changers, and challengers. Wiley Publications

2. BESSANT, J R. – TIDD, J. Managing innovation: integrating technological, market and organizational change. Wiley Publications