CERTIFICATE COURSE ON ARTIFICIAL INTELLIGENCE IN BIOMEDICINE

Course Name: Artificial Intelligence in Biomedicine
Course Duration: 30 Hours
Course Eligibility: This course is eligibility for Students, Faculty, Biomedical Professionals and Other Professional.
Course Fee: Rs 999/11.9 USD

Course Objectives:
- Gain a foundational understanding of Artificial Intelligence (AI), Machine Learning (ML) and their role in transforming biomedicine.
- Learn how AI is applied in healthcare areas such as medical imaging, diagnostics, genomics and drug discovery,
- Understand various types of biomedical data and gain practical experience in preprocessing and visualizing healthcare data.
- Study and apply key AI and ML algorithms, including classification, clustering, neural networks, and deep learning models, with a focus on biomedical use cases.
- Learn the ethical challenges, biases, and regulatory frameworks related to AI applications in healthcare, emphasizing responsible AI development.

Course Benefits:
- Comprehensive understanding of AI technology function
- Practical skills in healthcare
- Exposure to AI models and data science applications to essential tools
- Problem- Solving skills in biomedical Engineering that can be used in real-life scenarios
- Enhanced Career Prospects in Biomedicine and AI
- Ethical Awareness and Critical Thinking
- Networking and Collaboration Opportunities

Course Coverage:

1. Introduction to AI and Its Applications in Biomedicine
- Medical imaging, diagnostics, drug discovery.
- AI vs ML vs DL.
- Ethical considerations in AI for healthcare.

2. Overview of Machine Learning (ML)

- What is Machine Learning?
- Types of Machine Learning
- Learning Key algorithms
- Linear Regression, Decision Trees

1. Introduction to Data Science for AI
- The role of data in AI/ML
- Biomedical data types
- Introduction to data collection and annotation

2. Preprocessing Biomedical Data
- Data cleaning: Handling missing data, inconsistencies
- Data normalization and transformation techniques
- Introduction to feature selection and dimensionality reduction

3. Introduction to Supervised Learning
- Concepts of supervised learning
- Key algorithms
- Applications in disease prediction and diagnostics

4. Data Preprocessing and Visualization
- Introduction to Python and relevant libraries (NumPy, Pandas)
- Loading and cleaning a simple biomedical dataset
- Basic data visualization techniques using Matplotlib/Seaborn

5. Introduction to Medical Imaging, Genomics, Drug Discovery
- Overview of medical imaging techniques: X-ray, MRI, CT scan
- How AI is transforming medical imaging analysis
- Introduction to image classification using AI
- Role of AI in genomics: DNA sequencing, mutation detection
- AI for drug discovery: identifying potential drug candidates
- Case studies in AI-driven precision medicine

6. Ethical and Regulatory Considerations in AI for Healthcare
- Understanding biases in AI models
- Ethical challenges: Privacy, security, and transparency
- AI regulations in healthcare
- Future directions of AI in biomedicine

SL.No	Date	Day	Topic
1	04.11.2024	MONDAY	Introduction to AI, Machine Learning, and Deep Learning (2hrs)
			Overview of AI, Machine Learning (ML), Deep Learning (DL), and their roles in biomedicine
			Activites: Introduction to basic AI concepts, differences between AI, ML, and DL, case studies of AI in healthcare.
			Assessment: 10 multiple-choice questions (MCQs) on the differences between AI, ML, and DL.
2	05.11.2024	TUESDAY	History and Evolution of AI in Biomedicine (2hrs)
			The history and evolution of AI technologies in biomedicine.
			Activities:
			Explore key milestones in AI.
			Overview of pioneering AI applications in healthcare.
			Assessment: Create a timeline that highlights key historical AI applications in medicine.
3	06.11.2024	WEDNESDAY	AI Workflows in Biomedical Contexts (2hrs)
			Understanding AI workflows and pipelines in biomedical contexts.
			Activities: Review AI workflows, including data collection, preprocessing, model building, and validation.
			Review AI workflows, including data collection, preprocessing, model building, and validation.
			Assessment: 5 MCQs on AI workflows (e.g., steps in data preprocessing, model training, etc.)
4	07.11.2024	THURSDAY	Types of Learning in AI (Supervised, Unsupervised, Reinforcement) (2hrs)
			The three types of learning in AI.
			Activities:
			Explanation and examples of supervised, unsupervised, and reinforcement learning.
			Real-world applications in biomedical fields.
			Assessment : Questions to differentiate between supervised, unsupervised, and reinforcement learning.
5	08.11.2024	FRIDAY	Key Algorithms and Their Biomedical Applications (2hrs)
			Activities: Introduction to AI algorithms (e.g., decision trees, SVM).
			Introduction to AI algorithms (e.g., decision trees, SVM).
			Show a simple decision tree model in Python.
			Assessment: questions on AI algorithms.
6	11.11.2024	MONDAY	Types of Biomedical Data (2hrs)
			Activities:
			Different types of biomedical data (clinical, genomic, imaging).
			Assessment: short-answer questions on types of biomedical data.
7	12.11.2024	TUESDAY	Data Preprocessing and Feature Engineering (2hrs)
			Activities:
			Techniques for data preprocessing and feature selection.
			Assessment: MCQs on data preprocessing techniques.
8	13.11.2024	WEDNESDAY	AI for Bioinformatics and Omics Data (2hrs)
			Activities: Role of AI in analyzing omics data.
			Case Study: Review bioinformatics datasets and discuss AI applications.
			Assessment: Questions on AI applications in bioinformatics.
9	14.11.2024	THURSDAY	Predictive Modeling in Biomedical Data (2hrs)
			Activities: Overview of predictive modeling (regression, decision trees).
			Assessment: Questions on predictive modeling.
10	15.11.2024	FRIDAY	AI in Medical Imaging (2hrs)
			Activities: Applications of AI in medical imaging.
			Assessment: Questions on AI imaging techniques.

11	18.11.2024	MONDAY	AI for Early Disease Detection and Diagnosis (2hrs)
			Activities: AI applications in disease detection.
			Case Study: Discuss AI applications in early disease diagnosis.
			Assessment: Based on Case Study Analysis short questions on a disease detection case.
12	19.11.2024	TUESDAY	AI in Drug Discovery (2hrs)
			Activities: AI applications in drug discovery.
			Assessment: MCQs on AI in drug discovery.
13	20.11.2024	WEDNESDAY	AI in Personalized Medicine (2hrs)
			Activities: Role of AI in precision medicine.
			Case Study Discussion: Analyze personalized medicine examples.
			Assessment: Questions on AI in precision medicine
14	21.11.2024	THURSDAY	Ethical, Legal, and Regulatory Issues in AI (2hrs)
			Activities: Ethical and legal considerations.
			Discuss key ethical issues in AI.
			Assessment: MCQs on ethical and legal challenges, Write a brief on your stance regarding AI bias.
15	22.11.2024	FRIDAY	Future Directions of AI in Biomedicine (2hrs)
			Activities: Next-gen AI tech in biomedicine, Opportunities and challenges for AI in medicine.
			Assessment: Write a 300-word essay on how AI might transform surgery.