FORMAT FOR COURSE CURRICULUM

L	T	P/S	SW/FW	No. of PSDA	TOTAL CREDIT UNITS
3	-	2	-	-	4

Course Title: **A.I. in Healthcare**

Credit Units: 4

Course Level: **UG**

Course Code:

Course Objectives:

1. Machine Learning is an area of Artificial Intelligence that is concerned with the study of how to provide computers the ability to learn from experience. Become familiar with supervised machine learning and the types of problems it may be applied to.
2. Objective of this course is to introduce the fundamental set of techniques and algorithms that is applicable in Health Care, ranging from Machine Learning Models, Interpretability in Machine Learning methods to Natural Language Processing Based Health Care Applications
3. This course will focus on the theoretical understanding of these methods, as well as their computational implications.

Pre-requisites: Familiarity with basic AI, Linear algebra, Probability and Statistics

Course Contents/Syllabus:

	Weightage (%)
Module I : AI and Machine Learning — Applications and Foundations	**20%**
Introduction to Artificial Intelligence: terminologies, computational models of intelligence; conceptual frameworks from cognitive and educational psychology, neuroscience, information theory and linguistics, Philosophical Foundations of AI	
Module II: Interpretability in Machine Learning	**20%**
Introduction to Machine Learning ,Definitions of Interpretability and Examples, Social and Commercial Motivations for Machine Learning, A Machine Learning Interpretability Taxonomy for Applied Practitioners, Common Interpretability Techniques, Limitations and Precautions, Machine Learning Modeling from Healthcare Data, Benefits and Challenges	
Module III : Data Driven Approaches of Health Care Data	**20%**
Overview of Healthcare Data, Basic elements of Health Care Data, Sources of Healthcare Data, Internet of Things sensor Data, Electronic Medical Records/Electronic Health Records, Machine Learning Modeling from Healthcare Data, Machine Learning Modeling from Healthcare Data	

Module IV : NLP in Health Care	**20%**
Introduction to NLP, Basic Functions of NLP, Driving Factors Behind NLP in Healthcare, Computer-aided coding in NLP , NLP Solution between pharmaceutical companies and patients, NLP based Hospital Applications, Semantic Computing in Healthcare, NLP Tools into Clinical Care, Future of NLP in Healthcare	
Module V: Health Care Applications and Challenges	**20%**
Using AI for Disease Diagnosis and Patient Monitoring, Real-world applications of AI for diagnosis and patient monitoring, Patient Risk Stratification and Augmenting Clinical Workflows, Integrated Approach to Hospital Management and Optimization, Approaches to optimizing health care processes, Approach to AI for Regulatory Compliance	

Course Learning Outcomes:

1. Able to understand the importance of Artificial Intelligence in HealthCare
2. Able to understand the importance of Machine Learning in HealthCare
3. Design and development of AI and ML Enviornment
4. Able to understand the various algorithms of Machine Learning
5. Understanding of Health care data sources and creation of data driven healthcare applications
6. Able to understand role of NLP in Healthcare
7. Understand the principles, advantages, limitations and possible applications of popular AI and machine learning approaches in Health Care
8. Setup and solve typical machine learning problems, by implementation or by using established computer simulation tools.
9. Recognize typical effects of bad initialization and parameter selection and suggest ways to improve the results.
10. Be able to identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems in a range of Health Care Problem

Pedagogy for Course Delivery:

The course delivery pedagogy include: 1) lectures, 2) cases, and 3) Labs (Hands-on exercises). The concepts and state-of-the-art analytics practices will be introduced using lectures. Health care applications and case studies will be also introduced at appropriate modules to discuss the complexity of real time problems and how to make data-driven decisions using rigorous analysis. Delivery of course will be covered using e-content based on 4-quadrant approach.

Lab/ Practicals details, if applicable:

List of Experiments:

1. Build a neural network with one hidden layer, using forward propagation and backpropagation.
2. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate health care data sets.
3. Build and train deep neural networks, and apply it to Health Care Data.

4. Implement Hidden Markov Model using Health Monitoring Activities dataset.
5. Build a Classifier to classify patient record in category.
6. Topological Modelling and Classification Model of Health Care Data
7. Simulation of NLP Pre-processing steps to clean and process the medical data
8. Build a NLP Model to Recommend Healthcare Practitioners based on Patient Reviews
9. Natural language processing and machine learning to suggest best-fit answers for Medical Queries
10. Simulation of Interpretability Machine Learning Algorithm

Case Study: Download breast cancer data from the UCI Machine Learning Repository. Determine which features are most helpful in predicting malignant or benign cancer and to see general trends that may aid in model selection and hyper parameter selection. The goal is to classify whether the breast cancer is benign or malignant. To achieve this, use any machine learning classification method to fit a function that can predict the discrete class of new input.

Assessment/ Examination Scheme:

Theory L/T (%)	**Lab/Practical/Studio (%)**
75%	**25%**

Theory Assessment (L&T):

Continuous Assessment/Internal Assessment 40%					**End Term Examination 60%**
Components (Drop down)	**Attendance**	**Class Test**	**HA**	**Quiz**	**EE**
Weightage (%)	5	15	10	10	60

Lab/ Practical/ Studio Assessment:

	Continuous Assessment/Internal Assessment (_40_ %)				**End Term Examination (60%)**		
Components (Drop down	**Attendance**	Lab Record	Performance	viva	Performance	Viva	**Total**
Weightage (%)	5	15	10	10	30	30	60

Text & References:

Text Books

- Toby Segaran. 2007. Programming Collective Intelligence (First ed.). O'Reilly.
- Tony J. Cleophas and Aeilko H. Zwinderman. 2015. Machine Learning in Medicine - a Complete

Reference Books

- Stuart Russell and Peter Norvig. 2009. Artificial Intelligence: A Modern Approach (3rd ed.). Prentice Hall Press, Upper Saddle River, NJ, USA.
- Sunila Gollapudi, S. 2016. Practical Machine Learning. Packt Publishing Ltd.
- Peter Harrington. 2012. Machine Learning in Action. Manning Publications Co., Greenwich, CT, USA.
- Selected seminal and contemporary readings from peer-reviewed literature such as Proceedings of Machine Learning in Healthcare, Artificial Intelligence in Medicine, IEEE Transactions on Biomedical and Health Informatics,

Any Other Material:

Online Material:

- http://ai.stanford.edu/people/nilsson/MLBOOK.pdf
- https://www.routledge.com/Data-Driven-Approaches-for-Healthcare-Machine-learning-for-Identifying/Yang-Delcher-Shenkman-Ranka/p/book/9780367342906
- https://www.h2o.ai/oreilly-mli-booklet-2019/#report
- https://www.lexalytics.com/lexablog/text-analytics-nlp-healthcare-applications