Department of CSE

Details of Lesson Plan

S.No.	Particulars	Details
1.	Course Name	Artificial Intelligence and Machine Learning
2.	Course Code	MCSE-201
3.	Academic Year	2023-24
4.	Semester	2nd
5.	Number of Lesson plans	30
6.	Faculty Assigned	Surbhi Gupta

Surbhi

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Lesson Plan No. 3.7	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. gain a comprehensive understanding of convolutional architectures in deep learning, focusing on Convolutional Neural Networks (CNNs). b. understand the role of convolution in deep learning, and recognize the applications and advantages of convolutional architectures.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the real-world Applications of CNN. - Introduce the Advantages of Convolutional Architectures. 2. **Development** (30 minutes) a. Present examples of successful applications of CNNs, such as image classification, object detection, and facial recognition. b. Discuss how CNNs have outperformed traditional methods in computer vision tasks. c. Highlight the advantages of using convolutional architectures, including parameter sharing, translation invariance, and the ability to capture spatial hierarchies. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading books: a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville b. "Non-Convex Optimization for Machine Learning" by Mingkui Tan and Ivor W. Tsang c. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville d. "Neural Networks for Pattern Recognition" by Christopher M.

	Bishop e. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani f. "Regularization for Applied Inverse and III-Posed Problems" by Bernd Hofmann and Andreas Kirsch Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3.8	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. understanding of regularization strategies in deep learning. b. Explain the importance of regularization, understand various regularization techniques such as L1, L2, batch normalization, and dropout, and recognize their roles in preventing overfitting.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the challenges of training deep neural networks, focusing on overfitting. - Introduce the concept of regularization as a technique to prevent overfitting and improve the generalization performance of models. 2. **Development** (30 minutes) a. Define batch normalization as a technique to normalize the inputs of each layer within a mini-batch. b. Explain the motivations behind using batch normalization. c. Role of Batch Normalization in Regularization d. Discuss how batch normalization acts as a form of regularization by reducing internal covariate shift. e. Explain its impact on training speed and convergence. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
	  b. "Non-Convex Optimization for Machine Learning" by Mingkui Tan and Ivor W. Tsang
	  c. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

	d. "Neural Networks for Pattern Recognition" by Christopher M. Bishop e. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani f. "Regularization for Applied Inverse and III-Posed Problems" by Bernd Hofmann and Andreas Kirsch Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3.9	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	**Evolution of programming language**

Objectives	At the end of the lesson the student shall be able to:
	   a. understanding the concept of drop out in deep learning.
	   b. Explain the Implementation and Effects of Dropout.

Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).

Teaching Development	1. **Introduction** (5 minutes)
	
	   - Begin with a brief discussion on the Dropout.
	   - Introduce the concept of Implementation and Effects of Dropout.
	
	2. **Development** (30 minutes)
	
	   a. Define dropout as a regularization technique where randomly selected neurons are ignored during training.
	   b. Discuss the intuition behind dropout and how it prevents co-adaptation of neurons.
	   c. Explain the implementation of dropout during training and testing phases.
	   d. Discuss the effects of dropout on model generalization and its impact on model performance.
	
	3. **Exercise** (10 minutes) –
	   - Have discussion to summarize the lecture
	   - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	   a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
	   b. "Non-Convex Optimization for Machine Learning" by Mingkui Tan and Ivor W. Tsang
	   c. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
	   d. "Neural Networks for Pattern Recognition" by Christopher M. Bishop
	   e. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani

	f. "Regularization for Applied Inverse and III-Posed Problems" by Bernd Hofmann and Andreas Kirsch Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 2.3	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. gain a fundamental understanding of convexity in optimization problems and an introduction to convex analysis. b. Identify convex optimization problems, recognize key properties of convex functions, and understand the basics of convex analysis.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a discussion on the importance of optimization in various fields, from machine learning to finance. - Introduce the concept of convexity as a crucial property in optimization and mathematical analysis. - Highlight the significance of convex optimization in finding global solutions efficiently. 2. **Development** (30 minutes) a. Define convex sets as sets where the line segment connecting any two points in the set lies entirely within the set itself. b. Provide visual examples to illustrate convex and non-convex sets. c. Discuss key properties of convex sets, such as closure under intersection and convex combinations. d. Use examples to demonstrate these properties and their implications. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading books: a. "Optimization Models" by Giuseppe C. Calafiore and Laurent El Ghaoui" b. "Optimization Methods in Finance" by Gerard Cornuejols, Reha Tütüncü, and Robert J. Vanderbei c. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein

	d. "Numerical Optimization" by Jorge Nocedal and Stephen J. Wright Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 2.4	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. understand the fundamentals of the Gradient Descent optimization algorithm, its application in machine learning, and the key concepts related to convergence and learning rates.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the importance of optimization in machine learning and the role of Gradient Descent. - Introduce the primary objective: understanding the basics of the Gradient Descent algorithm. 2. **Development** (30 minutes) a. Define optimization in the context of machine learning and highlight its role in model training. b. Define Gradient Descent as an iterative optimization algorithm used to minimize a cost function. c. Discuss the role of gradients in determining the direction of steepest ascent and descent. d. Explain the steps involved in Gradient Descent: initialization, calculation of gradients, updating parameters, and convergence checks. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading books: **a.** "Optimization Models" by Giuseppe C. Calafiore and Laurent El Ghaoui" **b.** "Optimization Methods in Finance" by Gerard Cornuejols, Reha Tütüncü, and Robert J. Vanderbei **c.** "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein

	d. "Numerical Optimization" by Jorge Nocedal and Stephen J. Wright Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 2.5	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language

Objectives	At the end of the lesson the student shall be able to:
	  a. Gain a comprehensive understanding of Support Vector Machines and how Stochastic Gradient Descent can be applied to train SVM models.
	  b. Explain the principles of SVM, understand the role of Stochastic Gradient Descent in SVM training, and implement a basic SVM using SGD.

Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).

Teaching Development	1. **Introduction** (5 minutes)
	
	  - Briefly introduce the concept of classification and the need for effective classification algorithms.
	  - Define Support Vector Machines (SVM) as a supervised machine learning algorithm used for both classification and regression.
	  - Explain the key components of SVM, such as support vectors, hyperplane, and kernel functions.
	
	2. **Development** (30 minutes)
	
	  a. Explain the concept of linear SVM and how it finds the hyperplane that best separates different classes.
	  b. Discuss the importance of maximizing the margin between classes.
	  c. Introduce the concept of non-linear SVM and how kernel functions are used to transform data into a higher-dimensional space.
	  d. Provide examples to illustrate the application of different kernels.
	  e. Define Stochastic Gradient Descent as an optimization algorithm used for updating model parameters in an iterative and stochastic manner.
	  f. Discuss the advantages of SGD, such as efficiency and suitability for large datasets.
	
	3. **Exercise** (10 minutes) –
	  - Have discussion to summarize the lecture
	  - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	   a. "Optimization Models" by Giuseppe C. Calafiore and Laurent El Ghaoui"
	   b. "Optimization Methods in Finance" by Gerard Cornuejols, Reha Tütüncü, and Robert J. Vanderbei
	   c. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
	   d. "Numerical Optimization" by Jorge Nocedal and Stephen J. Wright
	
	Spend 5 minutes to wrap up and consolidate the leanings.

Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 2.6	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Gain a comprehensive understanding of how Stochastic Gradient Descent can be applied to train SVM models. b. Explain the principles of Stochastic Gradient Descent.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).

Teaching Development	1. **Introduction** (5 minutes)
	
	- Briefly introduce the concept of Stochastic Gradient Descent.
	- Define Stochastic Gradient Descent.
	- Explain the key components of SGD and its efficiency.
	
	2. **Development** (30 minutes)
	
	  a. Define Stochastic Gradient Descent as an optimization algorithm used for updating model parameters in an iterative and stochastic manner.
	  b. Discuss the advantages of SGD, such as efficiency and suitability for large datasets.
	
	3. **Exercise** (10 minutes) –
	- Have discussion to summarize the lecture
	- Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. "Optimization Models" by Giuseppe C. Calafiore and Laurent El Ghaoui"
	  b. "Optimization Methods in Finance" by Gerard Cornuejols, Reha Tütüncü, and Robert J. Vanderbei
	  c. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
	  d. "Numerical Optimization" by Jorge Nocedal and Stephen J. Wright
	
	Spend 5 minutes to wrap up and consolidate the leanings.

Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.

	2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3.1	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Define deep learning, understand its architecture, and recognize its importance in modern artificial intelligence.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the evolution of artificial intelligence and machine learning. - Introduce the concept of deep learning as a subset of machine learning that involves neural networks with multiple layers (deep neural networks). - Discuss the significance of deep learning in various applications. 2. **Development** (30 minutes) a. Define neural networks as computational models inspired by the human brain, consisting of interconnected nodes (neurons) organized in layers. b. Explain the basic structure of a neural network, including input, hidden, and output layers. c. Discuss the role of activation functions in neural networks and their importance in introducing non-linearity. d. Introduce common activation functions, such as the sigmoid and ReLU (Rectified Linear Unit). 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	 2. Suggested Reading books:
	     a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
	     b. "Non-Convex Optimization for Machine Learning" by Mingkui Tan and Ivor W. Tsang

	c. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville d. "Neural Networks for Pattern Recognition" by Christopher M. Bishop e. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani f. "Regularization for Applied Inverse and III-Posed Problems" by Bernd Hofmann and Andreas Kirsch Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3.2	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Understand multi-layered architecture of deep neural networks.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the multi-layered architecture of deep neural networks. - Provide examples of successful deep learning applications, such as image recognition, natural language processing, and speech recognition. - Discuss how deep learning has achieved breakthroughs in various domain 2. **Development** (30 minutes) a. Explain the concept of deep neural networks with multiple hidden layers. b. Illustrate the architecture of deep neural networks and how information flows through the layers c. Discuss how deep learning excels at automatically learning hierarchical representations of data, enabling better feature extraction. d. Briefly discuss current trends and advancements in deep learning, including the use of convolutional neural networks (CNNs), recurrent neural networks (RNNs), and transformer architectures. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
	  b. "Non-Convex Optimization for Machine Learning" by Mingkui Tan and Ivor W. Tsang

	c. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville d. "Neural Networks for Pattern Recognition" by Christopher M. Bishop e. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani f. "Regularization for Applied Inverse and III-Posed Problems" by Bernd Hofmann and Andreas Kirsch Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3.3	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Understand how neural networks are used for image recognition. b. Explain the basics of convolutional neural networks (CNNs), understand the key components of image recognition using neural networks, and recognize the applications and challenges in this domain.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the importance of image recognition in various applications, from computer vision to healthcare. - Introduce the concept of using neural networks for image recognition and its significance in modern technology. 2. **Development** (30 minutes) a. Define CNNs as a specialized type of neural network designed for processing grid-like data, such as images. b. Explain the basic architecture of CNNs, including convolutional layers, pooling layers, and fully connected layers. c. Discuss the role of convolutional layers in feature extraction and how this contributes to the effectiveness of CNNs in image recognition. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
	  b. "Non-Convex Optimization for Machine Learning" by Mingkui Tan and Ivor W. Tsang

	c. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville d. "Neural Networks for Pattern Recognition" by Christopher M. Bishop e. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani f. "Regularization for Applied Inverse and III-Posed Problems" by Bernd Hofmann and Andreas Kirsch Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3.4	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language

Objectives	At the end of the lesson the student shall be able to:
	  a. Understand how neural networks are used for image recognition.
	  b. Explain the basics of convolutional neural networks (CNNs), understand the key components of image recognition using neural networks, and recognize the applications and challenges in this domain.

Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).

Teaching Development	1. **Introduction** (5 minutes)
	
	  - Begin with a brief discussion on the Training and Fine-tuning (10 minutes):
	  - Introduce the concept of preprocessing techniques in neural networks.
	
	2. **Development** (30 minutes)
	
	  a. Explain the importance of preprocessing techniques, such as normalization and resizing, in preparing image data for neural networks.
	  b. Discuss data augmentation as a method to increase the diversity of the training dataset.
	  c. Provide an overview of the training process, including backpropagation and gradient descent.
	  d. Discuss the concept of fine-tuning and the importance of adjusting hyperparameters for optimal performance.
	
	3. **Exercise** (10 minutes) –
	  - Have discussion to summarize the lecture
	  - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
	  b. "Non-Convex Optimization for Machine Learning" by Mingkui Tan and Ivor W. Tsang

	c. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville d. "Neural Networks for Pattern Recognition" by Christopher M. Bishop e. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani f. "Regularization for Applied Inverse and III-Posed Problems" by Bernd Hofmann and Andreas Kirsch Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3.5	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	**Evolution of programming language**
Objectives	At the end of the lesson the student shall be able to: a. gain a comprehensive understanding of convolutional architectures in deep learning, focusing on Convolutional Neural Networks (CNNs). By the end of the lesson, students should be able to explain the fundamentals of CNNs, understand the role of convolution in deep learning, and recognize the applications and advantages of convolutional architectures.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the evolution of deep learning and the need for specialized architectures for tasks like image processing. - Introduce the concept of Convolutional Neural Networks as a key architecture in deep learning. 2. **Development** (30 minutes) a. Define the fundamental components of CNNs, including convolutional layers, pooling layers, and fully connected layers. b. Explain the purpose of each layer in the context of feature extraction and hierarchical learning. c. Dive deeper into the concept of convolution and its role in processing input data. d. Illustrate how convolutional layers detect local patterns and spatial hierarchies in images. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
	  b. "Non-Convex Optimization for Machine Learning" by Mingkui Tan and Ivor W. Tsang

	c. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville d. "Neural Networks for Pattern Recognition" by Christopher M. Bishop e. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani f. "Regularization for Applied Inverse and III-Posed Problems" by Bernd Hofmann and Andreas Kirsch Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3.6	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. gain a comprehensive understanding of convolutional architectures in deep learning, focusing on Convolutional Neural Networks (CNNs). b. understand the role of convolution in deep learning, and recognize the applications and advantages of convolutional architectures.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the real-world Applications of CNN. - Introduce the Advantages of Convolutional Architectures. 2. **Development** (30 minutes) a. Present examples of successful applications of CNNs, such as image classification, object detection, and facial recognition. b. Discuss how CNNs have outperformed traditional methods in computer vision tasks. c. Highlight the advantages of using convolutional architectures, including parameter sharing, translation invariance, and the ability to capture spatial hierarchies. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
	  b. "Non-Convex Optimization for Machine Learning" by Mingkui Tan and Ivor W. Tsang
	  c. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

	d. "Neural Networks for Pattern Recognition" by Christopher M. Bishop e. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani f. "Regularization for Applied Inverse and III-Posed Problems" by Bernd Hofmann and Andreas Kirsch Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 1.1	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Students will gain an understanding of the fundamental concepts related to Artificial Intelligence (AI), including its definition, scope, key objectives, challenges, and its role in problem-solving.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on students' prior knowledge of Artificial Intelligence. Ask if they have heard of AI and if they have any initial perceptions or ideas about it. - Define Artificial Intelligence: "Artificial Intelligence is the simulation of human intelligence in machines that are programmed to think and learn like humans." - Discuss the broad scope of AI, covering areas such as machine learning, natural language processing, computer vision, robotics, etc 2. **Development** (30 minutes) a. Explain the components of AI: machine learning, natural language processing, expert systems, robotics, and computer vision. b. Provide brief examples of AI applications in daily life, such as virtual assistants, recommendation systems, and image recognition. c. Discuss the various industries and fields where AI is applied, including healthcare, finance, education, and more. d. Highlight how AI is transforming processes and decision-making in these domains. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading books: a. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig

	b. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark c. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom d. "AI: A Very Short Introduction" by Margaret A. Bode Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 1.2	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Students will gain an understanding of the historical development of Artificial Intelligence (AI), including early developments, major milestones, breakthroughs, and the evolution of AI technologies over time.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a discussion on the importance of understanding the history of AI in shaping its current state and future developments. - Pose questions to gauge students' prior knowledge of AI history. - Introduce the lesson objectives: to explore the early developments, major milestones, breakthroughs, and the evolution of AI technologies. 2. **Development** (30 minutes) a. Present an overview of how AI technologies have evolved, including hardware improvements, algorithmic advancements, and the impact of computing power. b. Discuss the current state of AI, emphasizing technologies such as deep learning, reinforcement learning, and the integration of AI in various industries. c. Provide examples of contemporary AI applications. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading books: a. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig b. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark c. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom

	d. "AI: A Very Short Introduction" by Margaret A. Bode Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 1.3	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Students will explore the historical development of Artificial Intelligence (AI) and Machine Learning (ML), understand the current state of the art, analyze current trends and innovations, delve into cutting-edge technologies, and examine the impact of AI on various industries.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief overview of the importance of understanding the history and current state of AI. - Engage students in a discussion about their perceptions of AI and ML and any experiences they have had with AI technologies. - Introduce the lesson objectives: to explore the history, current state, trends, innovations, and impact of AI. 2. **Development** (30 minutes) a. Discuss early concepts and pioneers in AI, including Alan Turing, the Dartmouth Conference, and early AI systems. b. Emphasize the challenges and breakthroughs during this period. c. Provide examples of AI and ML applications in industries such as healthcare, finance, transportation, and entertainment. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
	  b. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark
	  c. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom
	  d. "AI: A Very Short Introduction" by Margaret A. Bode

	Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 1.4	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Develop an understanding of Symbolic AI, focusing on Decision Trees. By the end of the lesson, students should be able to define Decision Trees, understand their structure and functionality, and recognize their applications in problem-solving.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).

Teaching Development	1. **Introduction** (5 minutes)
	
	- Begin with a brief overview of Artificial Intelligence and its subfields.
	- Introduce the specific focus of the lesson: Symbolic AI and Decision Trees.
	- Discuss the importance of Symbolic AI in problem-solving and decision-making.
	
	2. **Development** (30 minutes)
	
	A. Definition of Symbolic AI
	  i. Define Symbolic AI as a subfield of AI that involves the use of symbols, logic, and rules to represent and manipulate knowledge.
	  ii. Discuss how Symbolic AI contrasts with other approaches, such as connectionism.
	B. Applications of Symbolic AI
	  i. Highlight real-world applications of Symbolic AI, including expert systems, knowledge representation, and reasoning.
	
	3. **Exercise** (10 minutes) –
	- Have discussion to summarize the lecture
	- Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
	  b. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark
	  c. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom

	d. "AI: A Very Short Introduction" by Margaret A. Bode Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 1.5	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. gain an understanding of symbolic computation, with a focus on its application in medical diagnosis. b. explain the concept of symbolic computation, understand its role in medical diagnosis, and recognize the advantages and challenges associated with its implementation.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the importance of accurate and timely medical diagnosis. - Introduce the concept of symbolic computation as a computational approach that involves manipulating symbols and expressions. - Highlight the significance of symbolic computation in complex problem-solving domains such as medical diagnosis. 2. **Development** (30 minutes) a. Explain how DT is used in medical diagnosis to represent medical knowledge, rules, and relationships. b. Discuss its role in decision support systems for healthcare professionals. c. Present case studies or examples showcasing successful implementations of symbolic computation in medical diagnosis. d. Discuss specific applications, such as expert systems and diagnostic reasoning 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading books: a. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig b. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark c. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom

	d. "AI: A Very Short Introduction" by Margaret A. Bode Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 1.6	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Gain a foundational understanding of Generalization Theory, focusing on its significance in machine learning. b. To define Generalization Theory, understand its role in model performance, and recognize its implications in real-world applications.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a brief discussion on the concept of learning in machine learning and the goal of building models that generalize well to unseen data. - Introduce the concept of Generalization Theory as a key framework in understanding how well a model extends its learning to new, unseen examples. - Highlight the importance of generalization in ensuring the practical utility of machine learning models. 2. **Development** (30 minutes) a. Define Generalization Theory as the study of how well a model performs on unseen data, beyond the training data. b. Discuss why generalization is crucial for the success of machine learning models. c. Explain the factors that influence generalization, including model complexity, dataset size, and the choice of algorithms. d. Illustrate how these factors impact a model's ability to generalize effectively. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading books: a. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig

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b. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark
c. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom
d. "AI: A Very Short Introduction" by Margaret A. Bode

Spend 5 minutes to wrap up and consolidate the leanings.
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<tr><td>**Evaluation**</td><td>

1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss.
2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework.

Spend 5 minutes to evaluate student assimilation of the lesson contents
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Lesson Plan No. 1.7	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Gain a foundational understanding of Statistical Learning, focusing on its principles and applications. b. To define Statistical Learning, understand key concepts, and recognize its role in real-world data analysis and prediction.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a discussion on the importance of data-driven decision-making in various fields. - Introduce the concept of Statistical Learning as a framework for making predictions and decisions using data. - Highlight the role of Statistical Learning in extracting meaningful insights and patterns from data. 2. **Development** (30 minutes) a. Define Statistical Learning (SL). b. Explain SL as the process of using statistical methods to estimate and make predictions about a target variable based on input features. c. Discuss the scope of Statistical Learning in data analysis, prediction, and decision-making 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
	  b. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark
	  c. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom
	  d. "AI: A Very Short Introduction" by Margaret A. Bode

	Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 1.8	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Develop a conceptual understanding of Sample Complexity in AI, explore the learnability of Finite Hypothesis Classes, and delve into the mathematical proofs and concepts that underlie the proof of learnability.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Begin with a discussion on the importance of sample size in machine learning and artificial intelligence. - Introduce the concept of Sample Complexity as a measure of how many examples are needed for a learning algorithm to perform well. - Discuss why understanding sample complexity is crucial for building effective machine learning models. 2. **Development** (30 minutes) a. Define Sample Complexity as the minimum number of examples needed for a learning algorithm to achieve a certain level of accuracy or error. b. Discuss how sample complexity relates to generalization performance. c. Explore factors that influence sample complexity, including the complexity of the hypothesis space, the noise in the data. 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these.
	2. Suggested Reading books:
	  a. "Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig
	  b. "Life 3.0: Being Human in the Age of Artificial Intelligence" by Max Tegmark

	c. "Superintelligence: Paths, Dangers, Strategies" by Nick Bostrom d. "AI: A Very Short Introduction" by Margaret A. Bode Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 2.1	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Understand the optimization techniques employed in Support Vector Machines (SVM) for linear classification. b. Explore strategies used in optimizing linear classification models. c. Analyze real-world applications showcasing the effectiveness of SVM and linear classification optimization.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).
Teaching Development	1. **Introduction** (5 minutes) - Brief review of SVM and its role in linear classification. - Importance of optimization in enhancing SVM performance. - Clarify the learning goals: understanding optimization in SVMs and linear classification, and recognizing real-world applications 2. **Development** (30 minutes) a. Recaptulate SVM fundamentals and its role in classification. b. Emphasis on the margin and the idea of support vectors. c. Mathematical Foundation of SVM Optimization d. Exploring optimization algorithms used in SVM, e.g., Sequential Minimal Optimization (SMO). 3. **Exercise** (10 minutes) – - Have discussion to summarize the lecture - Ask Questions Related to Topics
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading books: a. "Support Vector Machines" by Cristianini and Shawe-Taylor b. "Introduction to Machine Learning with Python: A Guide for Data Scientists" by Andreas C. Müller and Sarah Guido c. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron d. "Pattern Recognition and Machine Learning" by Christopher M. Bishop e. "Learning From Data" by Yaser S. Abu-Mostafa, Malik Magdon-Ismail, and Hsuan-Tien Lin

	f. "Hands-On Support Vector Machines with scikit-learn and TensorFlow" by Saeed Salkhordeh Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 2.2	Course Name: Artificial Intelligence and Machine Learning	Course No.: MCSE201

Topics	Evolution of programming language
Objectives	At the end of the lesson the student shall be able to: a. Gain an in-depth understanding of the Perceptron algorithm, the significance of margin in classification, and the proof of convergence in Perceptron training. b. Comprehend the mechanics of the Perceptron algorithm, explain the role of margin in classification, and understand the convergence properties.
Teaching Aids (if any)	a. PPTs. b. Green board (Chalk and Talk).

Teaching Development	1. **Introduction** (5 minutes)
	
	  - Start with a brief review of the concept of a perceptron and its role as a binary classifier.
	  - Introduce the objectives of the lesson: understanding the Perceptron algorithm, the importance of margin in classification, and the proof of convergence in training.
	  - Emphasize the practical applications of these concepts in machine learning.
	
	2. **Development** (30 minutes)
	
	  a. Define the Perceptron algorithm as a binary linear classifier that makes predictions based on a linear combination of input features.
	  b. Explain the process of training a perceptron to adjust weights for correct classification.
	  c. Discuss the optimization process in perceptron training, emphasizing the role of gradient descent and updating weights.
	  d. Illustrate the step-by-step optimization process with examples.
	
	3. **Exercise** (10 minutes) –
	  - Have discussion to summarize the lecture
	  - Ask Questions Related to Topics

Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading books: a. "Optimization Models" by Giuseppe C. Calafiore and Laurent El Ghaoui"

	b. "Optimization Methods in Finance" by Gerard Cornuejols, Reha Tütüncü, and Robert J. Vanderbei **c.** "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein Spend 5 minutes to wrap up and consolidate the leanings.
Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. 2. Evaluate students based on their participation in discussions, understanding of key concepts, and any assigned activities or homework. Spend 5 minutes to evaluate student assimilation of the lesson contents