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CHAPTER 1

INTRODUCTION TO SEMINAR TOPIC

Introduction to Seminar:

Artificial Intelligence is a concept that has been discovered and tweaked since around the 1940s. Under AI we have Machine Learning where we work with statistics and algorithms. Finally, we have Deep Learning under ML where we deal with deep concepts like image and speech recognition.
Branches of Automation

Briefly put, there are 3 branches in ML- Supervised Learning, Unsupervised Learning, and Reinforcement Learning. Reinforcement Learning(RL) is a type of machine learning technique that enables an agent to learn in an interactive environment by trial and error using feedback from its own actions and experiences.

ML Types

Motivation behind seminar topic:
For new age problems in this decade, we need a solution that can create the perfect model to solve that particular problem. That's what the RL aims for.
RL has various interesting applications in the modern world viz medicine, healthcare, self-driving cars, robotics, gaming, marketing, advertising, etc.

Aim and Objective(s) of the work

Seminar aim:
The aim of this seminar is to understand the complex subject of RL and DRL and simplify them with studying about applications of the same.

Seminar objectives:
Studying basic concepts in Reinforcement Learning.
Learning how to integrate Reinforcement Learning with Deep Learning or neural networks.
Exploring the applications of single-agent environments.
Exploring the techniques involved in multi-agent environments.

Introduction to RL and DRL:

Reinforcement Learning is a subfield of machine learning that teaches an agent how to choose an action from its action

space, within a particular environment, in order to maximize rewards over time.
When Deep Learning is integrated with RL it is known as Deep Reinforcement Learning. It is seen in many real-world applications around us like games, recommendation engines for famous e-commerce websites, video-streaming platforms, etc.
This seminar will mostly cover the application of DRL which is used in recommendation systems. Recommendation systems are something that we all come across daily from recommendations on Google maps to OTT services like Netflix, Amazon. Creating robust self-supervised recommendation systems can go a long way in increasing sales for e-commerce websites or increasing watch time for video streaming platforms. While making recommendation systems it is important to consider multiple factors like the interactions between users and items, etc. Reinforcement learning is used to enhance the recommendation systems by concentrating on the interaction between the agent i.e. the user and the environment i.e. the website and maximizing the cumulative reward for the agent based on the interaction.
This seminar focuses on how reinforcement learning and deep reinforcement learning work and their use in 2 states of art recommendations frameworks namely Self-Supervised Q-learning (SQN) and Self-Supervised Actor-Critic (SAC).
Objectives of this seminar include gaining a good understanding of MDP and applying this knowledge to understand the 2 recommendations frameworks mentioned above.

CHAPTER 2

LITERATURE SURVEY OF Seminar Title/Topic

One of the best papers according to the ICLR 2020 Conference was “Never Give Up: Learning Directed Exploration Strategies”.
The authors proposed a reinforcement learning agent to solve hard exploration games by learning a range of directed exploratory policies.

Atari game RL
“End to End Learning for Self-Driving Cars” is a brilliant work where the authors dug deep into the world of self-driving cars and trained a convolutional neural network (CNN) which is used to map raw pixels coming from a single front-facing camera directly to steering commands.
“Genie: A Generator of Natural Language Semantic Parsers for Virtual Assistant Commands” - This paper has the Genie toolkit that can handle new compound commands with variably less manual effort.

“Recommendation systems: Principles, methods and evaluation” - This paper explores potentials of different prediction techniques and the different characteristics and in recommendation systems.

“An Overview of Chatbot Technology” - The authors explain about chatbot classification based on various factors, such as the need they serve, the area of knowledge they refer to, etc. They present the architecture of modern chatbots and also mention the main platforms for their creation.

“DynaMIT: a simulation-based system for traffic prediction” - DynaMIT supports both prescriptive and descriptive information. It generates prediction-based guidance with respect to departure time, pre-trip path and mode choice decisions and en-route path choice decisions.

CHAPTER 3

Reinforcement Learning & Deep Reinforcement Learning

Reinforcement Learning is defined as a Machine Learning method that is concerned with how software agents should take actions in an environment.
Reinforcement Learning is a part of the deep learning method that helps you to maximize some portion of the cumulative reward.
This neural network learning method helps you to learn how to attain a complex objective or maximize a specific dimension over many steps.

RL Terms

Take the example of a self-driving car, where the car is the agent, and the track that it has to cover is the environment. Here, positive rewards may include breaking or turning at the right point, stopping at a red light, etc and negative rewards may include crashing with another car/person, etc. So the clear goal for the agent, in this case, would be to reach the destination with maximum reward. The agent is programmed to make the right decisions at the right time. Markov decision processes give us a way to formalize sequential decision-making.
Terminologies:

Agent: It is an assumed entity which performs actions in an environment to gain some reward.

Environment (e): A scenario that an agent has to face.

Reward (R): An immediate return given to an agent when he or she performs specific action or task.

State (s): State refers to the current situation returned by the environment.

Policy (π): It is a strategy which is applied by the agent to decide the next action based on the current state.

Value (V): It is expected long-term return with discount, as compared to the short-term reward.

Value Function: It specifies the value of a state that is the total amount of reward.
It is an agent which should be expected beginning from that state.

Model of the environment: This mimics the behavior of the environment.

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