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Rajesh Kumar (SMIEEE, Fellow [IET(UK), IE(I), IETE], LMCSI, LMISTE) received the B.Tech. (Hons.) degree in Electrical Engineering from the National Institute of Technology (NIT), Kurukshetra, India, in 1994, the M.E. (Hons.)and Ph.D. degrees in Power Systems and Intelligent Systems from the Malaviya National Institute of Technology (MNIT) Jaipur, Rajasthan, India, in 1997, and 2005 respectively. He was a Postdoctoral Research Fellow with the Department of Electrical and Computer Engineering, National University of Singapore (NUS), Singapore, from 2009 to 2011. Currently, he is working as a Professor with the Department of Electrical Engineering, MNIT, Jaipur.

His research interests focus on Intelligent Systems, Data Driven algorithms and analytics and Smart Grid. He holds 16 patents/patent applications and published more than 600 research articles in international conferences and journals. He has supervised 25 Ph.D. and more than 50 master theses. He is recipient of several academic, best papers, best theses, and professional awards. He has received the Career Award for Young Teachers in 2002 from Government of India. He has delivered 200+ keynotes/expert talks in various Faculty Development Programs and workshops.

He was conference program chair PEDES 2018, general co-chair ICRAIE 2018, IICPE 2018, ICPS 2019. He was the general chair of PEDES 2020, AISCC 2020, GCAIA 2020, PEDES 2022. He has been an Associate Editor of IEEE Access, IEEE ITeN (Industrial Electronics technology News), Swarm and Evolutionary Computation, Elsevier, IET Renewable and Power Generation, IET Power Electronics, International Journal of Bio Inspired Computing and CAAI Transactions on Intelligence Technology, IET.

He was IEEE counselor, MNIT student branch, founding faculty advisor IEEE IAS student chapter at MNIT, Honorary Secretary of IETE Rajasthan Chapter, Excom IEEE Delhi PES-IAS and Vice Chairman IEEE Rajasthan Subsection.

Topic 1: From Nature to Engineering Optimization: Exploring the Power of Algorithms Inspired by Natural System

The requirement of intelligence in optimization has increased due to the complexity and detailed system modeling and data driven applications. The search for better algorithms that can find global optimal solutions to complex optimization problems is ongoing. Traditional optimization methods, such as gradient descent and linear programming, are often limited by their ability to get trapped in local optima.

Nature is an abundant source of inspiration for developing new optimization algorithms. By observing the behavior of various living organisms and ecosystems, researchers have been able to create algorithms that mimic natural processes. As a result, researchers are exploring alternative approaches, including nature-inspired algorithms and machine learning techniques. These methods can perform multi-path searches and have the potential to converge on global optima. One of the challenges in developing these algorithms is balancing the exploration of new solutions with the exploitation of promising ones. This is often referred to as the exploration-exploitation trade-off. Despite the challenges, the development of better algorithms for finding global optimal solutions has the potential to significantly improve a wide range of applications, from engineering design to financial modeling. Over the years, various classes of algorithms have been developed that include physics based, human based, bio based, system based, evolutionary based, swarm-based algorithms. This Talk will focus on the philosophy and behavior study to develop swarm based algorithms (PSO, BFO, BO, ACO, CSO, ABC, DBC, CSA, FA, BA, FFO, SSO, GWO, ALO, MFO, WO, EHO, JAYA, DFO, BSA, SO, GHO, HBO, MSA, RA, HHO, SSA etc) Additionally combining human intelligence and parametric studies to develop new algorithms will be discussed with case studies.

Topic 2: Intelligent Power Management and Control of Electric Drive in Electric Vehicle using Reinforcement Learning

This tutorial suggests an energy management system (EMS) for hybrid electric vehicles (HEVs) based on a model based and model-free reinforcement control mechanism. To improve the learning process and reliability of the EMS framework, various reinforcement learning algorithms, namely Q learning, SARSA, deep Q network (DQN), deep deterministic policy gradient (DDPG), Trust Region Policy Optimization (TRPO) and Proximal Policy Optimization (PPO), Soft Actor -Critic (SAC), Twin Delayed Deep Deterministic Policy Gradients (TD3), Hindsight Experience Replay (HER), Distributional Reinforcement Learning with Quantile Regression (QR-DQN) and Asynchronous Advantage Actor-Critic (A3C) are analysed. The performance of algorithms is evaluated under various driving conditions, and the findings are presented in terms of reliability and fast convergence.

The significance of this work lies in its potential to advance the development of more effective energy management strategies for hybrid electric vehicles (HEVs). Compared to traditional rule-based methods, the proposed framework is more efficient and adaptable to changing environments, without requiring extensive domain knowledge.

The talk can serve as a basis for the creation of even more advanced and efficient energy management strategies for HEVs, contributing to the development of more sustainable and efficient transportation systems.

Topic 3: Smart Inverter Control with Predictive Analytics and Machine Learning for Unintentional Islanding Prevention in Solar PV Distributed Generation

With current policies promoting the adoption of renewable energy, there is an expectation of an increase in the use of solar photovoltaic generation on distribution feeders. As the load behavior of the power grid continues to evolve away from the traditional constant power model, integrating static inverters and different types of load models can result in a new category of disturbances. In the presence of grid side disturbances, such as voltage fluctuations or frequency variations, these interactions can lead to anomalous situations. These anomalous situations can, in turn, affect the integrity of distribution networks and compromise the stability and reliability of the power supply. Unintentional islanding of a power distribution section that includes a solar PV inverter and electrical loads is considered a direct outcome of such incidents, which can activate protective devices located at the connection point of the distribution system. To protect such ADN, it will be important to investigate and analyze such conditions. This proposal contrasts with existing anti islanding measures once the island is formed.
The talk focus towards data collections, scenario generation, analytics, machine intelligence, real time operational challenges and development of portable device to fit with inverter to make it smart for promising applications in small scale distribution generation system.

Topic 4: A framework for secure multi-agent cloud energy storage

This talk highlights the significance of Cloud Energy Storage (CES) in promoting the development of micro-grids, Energy Internet, and related fields. It explains the definition, characteristics, essential technologies, and business models of CES, mainly for residential prosumers. CES is a new generation Energy Storage (ES) system that utilizes the sharing economy concept in the existing power grid. One of its most notable features is that both prosumers and consumers can access ES services without the need for deploying ES facilities. This means that the same set of ES resources can be shared among different users at different times, thereby maximizing the utilization of distributed renewable energy sources and reducing infrastructure and operational costs of energy storage resources. With CES, users can access shared energy storage resources anytime, anywhere, and on-demand, and pay for the services based on their usage requirements.
The concept consists of various vectors like advanced optimization techniques for storage management, advanced machine intelligence techniques for historical energy consumption and self-generation power profiling for big data analysis and prediction technology to predict users' charging and discharging demands and future electricity price trends, a suitable multi-agent and security mechanism is required for users who are willing to move to take cloud energy storage service. The blockchain, a distributed database technology, can provide network security during operation.

Topic 5: Deep Reinforcement Learning based Control for Complex and Uncertain Environments

Control theory has played a vital role in engineering and scientific advances over the past century. It provides a framework for modeling, analyzing, and controlling dynamic systems, including robotics, aerospace, and process control. However, traditional control methods, such as PID controllers, model-based control, and optimal control, have limitations when it comes to handling complex systems and environments with uncertainties.
Deep Reinforcement Learning (DRL) has emerged as a new paradigm for control, offering a powerful approach to model-free decision-making in complex and uncertain environments. DRL combines deep neural networks and reinforcement learning to enable agents to learn from

experience and improve their performance over time. This approach has demonstrated remarkable success in a wide range of applications, including robotics, autonomous driving, game playing, and recommendation systems.

This presentation examines into the difficulties of Reinforcement Learning (RL) and Deep Reinforcement Learning (DRL) and their practical applications in signal noise reduction particularly for filtering surface electromyography (sEMG) signals and motion control of robotic hand, humanoid robots, and self-driven vehicles.