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Introduction -

In today's outgrowing world it is the need for us to build systems that are effective to us but moreover can perform our tasks better. Does that mean that we no longer must work, and the systems will take our jobs? NO! this means that we must build systems that can act on behalf of us, act independently without our constant interference and in a distributed combined way while continuing the interaction with us. This means that the interconnected systems need to cooperate and keep aside their different interests and perform to our needs and expectations. This is where agents or multi-agents come in picture. An agent is a system which can take its own decision on behalf of the user without interference of user. Some famous definitions of an agent like this one adapted from [Wooldridge and Jennings, 1995] [1] is, "An agent is a computer system that is situated in some environment, and that is capable of autonomous action in this environment in order to meet its delegated objectives". In the field of AI an agent can be viewed as something perceiving the environment through sensors and acting upon through actuators. To describe the intelligence factor of any agent we can say that it should possess these qualities, it should be reactive i.e., can be able to perceive the environment and respond to factors, it should be proactive i.e., it can take initiative to fulfill the needs or objective of the system and lastly communication i.e., it should be able to interact with other agents in the system there are some fewer common characteristics considered by various people such as identifiable, goal-driven and heterogeneity amongst other. They support complex individual interactions. The major factors of any agent systems are that they are autonomous, they can decide upon themselves whether to do certain tasks, they are always smart and flexible and active. In the simplest and understanding terms we could consider a thermostat sensor to be an agent. The main difference between any other system and an Agent based model is that agents are situated in an environment with real world approaches and are aware of their surroundings they possess decision-making heuristics and have a connectiveness. Agents being autonomous entity, they are not influenced by external directions and have information processing capability. In [2] the author puts forth a classification dimension for agents they are, based upon autonomy, cooperation, learning, mobility, reactiveness, heterogeneity.

Multiagent system is that which consists of various such agents that interact with one-another and act in the environment, have individual spheres of influence and are connected. Multiagent system are often recognized as self-organized systems and can solve problems that are difficult for an agent to solve. Stone and Veloso define a MAS (multi-agent system) as ' a loosely coupled network of problem-solving entities

that work together to find answers to problems that are beyond the individual capabilities or knowledge of each entity'. It is like a middleware that helps with communication and coordination of various activities. Every agent in the system interacts with one another and the environment based upon its rules for every small task and adaptive complex decisions. Compared to a single agent system a multiagent system has the following advantages, all the computational resources and capabilities are distributed over the network, in simpler words an MAS is decentralized and is not affected by a failure of a single node, we can combine multiple systems and add them to a group, it is robust, efficient for information retrieval and highly scalable in nature, local interactions can be modeled and analyzed. The outcome of the MAS depends upon the actions by individual agents, so every agent in the system will influence the result. Currently agent systems are widely used in various applications such as email filters, air traffic systems, etc.

Agent v/s Non-Agent system -

The most important factor that separates the agent-based system from an no agent system is the ability to interact and stimuli to its environment along with another important factor of understanding behavior patterns. Agent based system are smart enough to make their own decisions and have a judgement of their own. Their decisions are based upon the situation and external environment stimuli along with other factors. They can provide information about the dynamics of environment in real time. With the use of various models of ML and AI they can provide with learning and adaptations of various techniques. An agent-based system has a very important behavior phenomenon called as emergent phenomenon which enables the system to think and act that like a human behavior. Our human subconsciousness helps us to decide on various activities, make decisions, we can call these actions as a set of rules which regulate our behavior. Agent based systems have a similar behavior and include all risks and rewards from the environment. We can say that agent system are simulation techniques that model our manners. Emergent phenomena emerge due to interactions between individual agents, for e.g. traffic jam happens, this is because of the behavior of individual and their interactions, a vehicle moving in opposite direction that causes it, this is a case of emergent phenomena which is very difficult to predict by any system, but a agent based system is the canonical approach for tracking such emergent phenomena and can truly predict a heard behavior by its bottom up approach if every individual is treated as an agent. Researchers at Icosystem corporation say that consider a game involving 10-40 people, choose 2 people at random, A and B, ask all to always let A in between B and them, we can observe that after a while all will observe everyone in a clustered knot, such behavior of emergent phenomena can be predicted by an agent system and can

deal with more complex phenomenon which include learning and adaptations. One of the most important reason for one to use agent-based system than a non-agent system is such intelligence and potential for solving emergent phenomenon.

A non-agent system such as one that analyses the bills of a shopping store to predict what one will buy and in general tells the profile for shopping etc. is still in limitations when it is coming to using data, i.e., such system is not still using the full potential of the data than what agent-based system could do. An agent-based system can in real time track the shopping cart of the customer and consider such individual as an agent in the system then to predict what the customer will purchase next or analyze the system in real time etc., then predicting on historic data over limited scope.
In general, we can say that any agent-based system can have the capacity to handle counterintuitive situations which are normally very difficult or even not possible for any non-agent system. There are various such cases where the concept of emergent phenomena can be handled greatly by agent systems like traffic flows, stock market analysis, operational organizational risk and designs which are not limited to this, tackling day to day problems and providing solutions to them is also possible with agents' systems along with an important solution which is only provided by them, that is Negotiation. In technical terms we can consider negotiation as a mutual understanding between systems, where they communicate and come to a desired solution which works best for all. This step consists of various elements such as identification of problem and modification based upon desired usage, mains steps happening are exchange of information along with individual evaluation and lastly final agreement. Such behavior can only be seen in agent-based systems, so basically, we can say that compared to a non-agent system an agent-based system can evaluate unanticipated behavior. An example which can be predicted by only an agent-based system is the prisoner situation where 2 prisoners are locked in 2 separate rooms i.e., in no way they can talk to one another, they are given a choice that if anyone accepts the crime, he'll be free and other will be jailed for 3 years, if both accept the crime, they'll be jailed for 5 years and if none accepts then they'll be jailed for 2 years. In such situation without any past data or any sort of information a non-agent system will fail to predict the result but an agent-based system works in a way that it'll calculate the best factor amongst then narrowing down to an individual decision and predicting the output in every scenario which will give the output that both don't accept the crime and face 2 years prison which can be the best solution. In such scenarios agent systems are helpful as they have a sense of intelligence which other systems don't and hence it's always an advantage to use agent systems that non agent for the simplest of the tasks to the most crucial one's.

Our company focuses mostly on providing services of contract management to Enterprise businesses by the means of our product, embedding an agent-based culture into the system could work miracles for us, and help us grow further. Our systems currently analyze the data about how our system is used by the client,

what features do they use most, how we can improve what we offer, along with what the clients' needs the most, which then helps us pitch our contracts and enhancement. Even though we currently have blockchain and ML technologies used, they are limited to legacy data migration, and basic predictions for moving forward with life cycle. An agent-based model would help us track the usage of every individual for every client in real time, and help us make our system more efficient, and improve the way our system works by focusing on the resources needed when and where. The system currently has a single client on single VM, after using ABM we could use a single VM for various clients without hampering our performance and efficiency while reducing cost.

How will our company progress with ABM-

An ABM does not learn only based on past data and predict based on some trends but learns based on the behavior of the system, online learning along with trial and error and its interaction with the environment. It focuses on understanding the environment and perceive it to move forward to a new state. System which will benefit by parallelization have a greater advantage, in such systems if parallelization can speed things up or help with learning then agent model has shown to improve efficiency for such systems. Using ABM is a collective computational intelligence, by which the existing models can greatly benefit, as agents are a new paradigm shift for development in cases of distributed applications and parallelization their use can show significant result in term of performance and can open new possibilities for us for development, this collective computational intelligence can help various machine learning algorithms where a combined effect is required which can be achieved by combining output of various agents. In distributed environment multi agents can run in parallel to get some local results that can then get combined to a global solution. The MAS learns in parallel, and every agent is involved in the learning, the combined effort increases the speed of learning which then increases the overall speed, every agent get a reward and each agent considers other agents in the environment 1 level below them, this concurrent behavior is used on grid world navigation which proves that parallel learning can reduce the learning time. In [3] the author suggested that a reinforcement learning approach with a mixture of Bayesian networks and stochastic models showed a property of adaptation to the environment when used with agents. Consider a multi agent system which is working together to learn a task, all these agents are heterogenous in nature, when each agent uses a different machine learning technique, the system has a combination of knowledge of various such systems, such system can give better output in less amount of time due to their nature. In [4] the author proposes that when Evolutionary Dynamics were used for Qlearning the analysis of the strategies predicted desired parameters for RL in

MAS that achieved Nash Equilibrium with best utility. Ensemble techniques can improve the performance of machine learning methods, Effective ensembles can be created using simple agents that can hence show improvements in ML techniques. Distributed learning problem was solved using an approach [5] that selects instances and attributes in cooperation between agents which assures great results. We can see that by using agents in ML systems we can achieve dynamic trackable solutions, can have parameters sensitivity defined and a robust model along with assured scalability and interoperability. Our systems mostly run on a distributed environment so using ABM will show us progress, we currently use ML techniques only for legacy management with embedding agent systems in our model we could use ML for all lifecycles and add value to the company. With this approach we can move further and use AI and ML techniques for all purposes in the contract rather than legacy uploads of businesses. Right from creating a contract to automatically deciding what clauses to use in contract based on the type of contract and sending then for approvals will all be possible with this. Let's take our company to new heights by the means of agents!

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