

# Futuristic Advancements in AI for Knowledge Management Systems and Multi Model Based Agent

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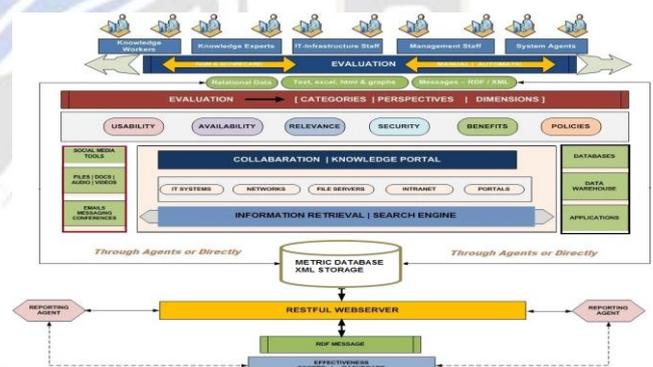
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**Abstract.** In recent years, especially between the years of 2012 and 2022, the use of Artificial Intelligence (AI) in the education industry has grown significantly. Some of the key areas are Task Automation, Personalized Learning, Smart Content Creation, Teaching The Teacher, Knowledge Repository, Portals, and Maps. AI has already been applied to many educational systems that help develop skills and facilitate easier exchange of knowledge. The Internet Of Things (IoT) based smart schools and collaborative e-learning platforms would be the next big thing, which can take the education sector to the next level, parallel to medical, automobile and other industries. AI can provide many benefits, such as efficiency, and personalization, as well as streamline both automation and admin tasks to allow easier and faster accessibility for knowledge seekers. AI Based Smart Knowledge Management System (KMS) and portal would provide better searching and mapping capabilities, to find the relevant assets for researchers/students, who would like to learn and leverage their knowledge in any domain. Some of the new AI based technologies include MLOps, AutoML, ExplainableAI and Transfer Learning. This research work introduces and explains related literature on these topics to help enable effective, scalable and automatic Knowledge repositories, Systems and K-Map populations.

**Keywords -** Knowledge Management Systems (KMS), AI, Knowledge Management, ML, RPA, K-MAP, e-Learning, Knowledge Repository, IoT, MLOps, AutoML, ExplainableAI and Transfer Learning.

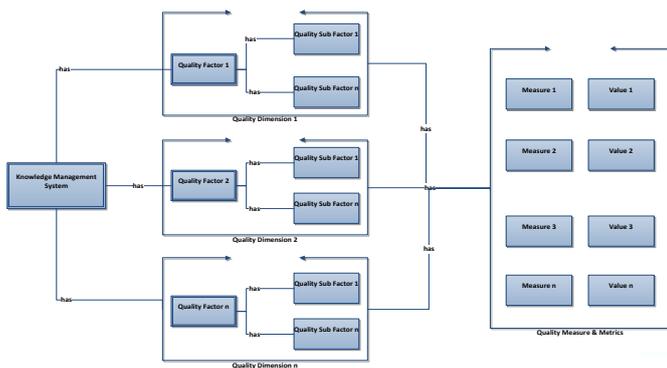
## I. INTRODUCTION

Collecting and identifying the worth of the academic and research related knowledge within the institution is a vital step. There are various methods through which knowledge is transferred to the students and researchers studying in the higher learning institutions. Usefulness of the existing documents, knowledge assets can be achieved through the hybrid method proposed [1]. Speed of knowledge exchange and the new ways or tools especially social media tools provide extended sources of knowledge which will be highly helpful for the students apart from the regular knowledge assets available in the existing knowledge portals and repositories. There should be good amount of policies and guidelines need to be developed and implemented for effective sharing of the knowledge [2]. The multi-dimensional web services based framework can represent all the important components for building and representing KMS [3]. The web services based KMS framework represented in Figure 1, has five important layers. The fifth layer is the web services based layer, which includes a RESTful web server, a set of web services which are helpful for integrating multiple knowledge assets for effective dashboard reporting on the utilization of the KMS built using the framework.



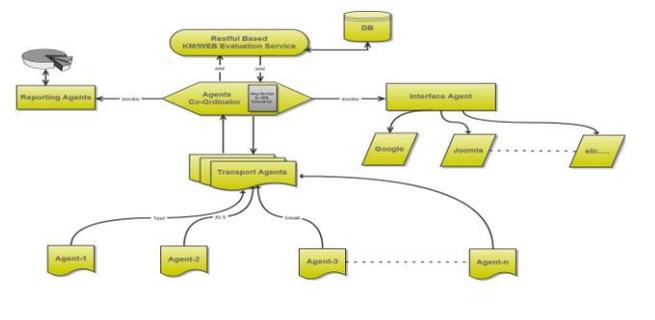
**FIGURE 1. KMS Framework**  
**II. Multi-Model Agent Based Model**

Multi modal based agents can extract and convert the available knowledge assets to a streamlined or uniform knowledge assets which can be stored in the repository. The main thing in constructing the multi model based model is finding the right quality factors based on the institutional needs. Figure 2 provides the logical and easy to implementable model for building and evaluating KMS [4].



**FIGURE 2.** Multidimensional Knowledge Management Model

Figure 3 depicts multi modal based agent architecture and can be helpful to process any type of documents using multiple agents which can be implemented using AI and ML. Knowledge about and from documents, processes, best practices, products are very important and those knowledge assets have to be periodically assessed for its effectiveness.



**FIGURE 3.** Multi Modal Based Agent Architecture

The agent technique uses agents to enable the user to share their knowledge assets among their emails. The file transferring agent can extract the useful knowledge assets from the respective warehouse, whereas the security agent can protect the knowledge assets using the right decryption/encryption technique. The potential value of the KM systems, infrastructure components and services can be totally realized through the multi agent approach. There are multiple research avenues and opportunities to investigate agent communications, information and knowledge sharing through agents, and how agents can be used as systems integrators [5].

Facts and beliefs about agents have to be communicated periodically and have to store the state of the present environment. Information regarding Relationships among the agents and associated participating models should be also in a knowledge database about agents [6]. Collaboration among agents helps administrators to explore the intentions as well as problem solving plans among and collaborative problem-solving plans among the agents. The expert systems using agents can be designed for leveraging dynamic knowledge exchanges between knowledge seekers and providers. Thus,

there are more research directions for implementing the dynamics between different agents and different types of knowledge workers using multimodal architecture [7].

### III.Role Of AI And ML

The following section introduces and explains related terms and technologies which enable effective, scalable and automatic Knowledge repositories, Systems and K-Map populations through AI/ML based automations. The important terms such as Industry 4.0/5.0, AI, ML and DL are discussed. The last section discusses more about the latest trends and tools related to AI which are helpful for automating KMS to leverage effectiveness [8].

The industries went through many evolutions and standards. Industry 1.0 applies mechanization, steam power and weaving looms and others for a simple use of machines. In industry 2.0, mass production, assembly line and electrical energy was used for speeding up the production. Industry 3.0 started using computers and electronics for automation. Industry 4.0 applies all the objects in the factory or industry as cyber physical systems and uses Internet of Things and Networks effectively.

Industry 4.0 is about the interconnectedness of machines and systems for optimal performance. Unlike the concept of Industry 4.0, Society 5.0 is not restricted only to a manufacturing sector, but it solves social problems with the help of integration of physical and virtual spaces. All the building blocks created by Industry 4.0 and 5.0 create huge opportunities for the higher learning institutions to prepare or update the curriculum and teaching methodologies to train the engineers as well enhance the research works.

Artificial Intelligence is one of the important studies which deals with application of statistics, math, reasoning, machine learning methods, expert systems and robots to provide automation. Artificial Intelligence or Computational Intelligence deals with techniques which enable computer systems or software programs to simulate or mimic human intelligence using logical statements, rules, machine learning and/or deep learning models.

Machine learning involves a set of techniques or methods which uses statistical techniques to enable machines to improve tasks by following the given model strictly. Deep learning is one level above machine learning which uses a set of algorithms which permit the software programs or intelligent agents such as robots to train themselves to perform the tasks.

Machine learning is classified into three major types of learning namely Unsupervised learning, Supervised learning and Reinforcement learning. Supervised learning uses labeled data and direct feedback in order to predict desired outcomes. Unsupervised learning doesn't use labels and feedback to predict the outcome or hidden pattern from data.

Reinforcement learning uses both the decision making process and rewarding system to learn a series of actions to find and decide the best outcome.

SUPERVISED-LEARNING - Regression based, Classification based algorithms
UNSUPERVISED-LEARNING - Clustering based, Association based algorithms
SEMISUPERVISED-LEARNING - Self Training, Speech Recognition based algorithms
REINFORCEMENT-LEARNING - Q Learning, Deep Q Network based algorithms

FIGURE 4. Types of Machine Learning

Adoption of Artificial intelligence can enable organizations to automate many administrative tasks, order or organize the tasks effectively using some schemes and save time, money and resources. AI enables effective communication and information exchange between multiple resources of the institutions. The resources can be faculties, professors, research scholars and students. Application of AI, ML and DL can be used to collect knowledge assets automatically. Machine learning techniques such as classification, clustering and text mining can be used for improving the collection of knowledge assets for effective searching, clustering and classification. There are several smart AI based automation and administration tools using agents that were developed recently in the last two decades for effective administration of the knowledge assets as well as the institutions[9].

Some classic examples are Virtual Reality using AI, Gamification, Learning Apps using mobile and web, Biometric based attendance, Face recognition based attendance, digital transformation of all the assets such as digital wallets for the students and professors. This work primarily emphasizes how AI and ML can be used for automation of knowledge management within the institution. There are new modern techniques introduced such as MLOps, Auto ML, Explainable AI, Transfer Learning and Robotic Process Automation(RPA) which are very much useful for effective automation of KMS.

MLOps is a new buzzword and introduced or coined after DevOps became popular. DevOps aims to integrate development and operations, whereas MLOps aims to integrate ML for performing ML based operations on any application data. It is nothing but a set of practices for collaboration and improved communication between data scientists or ML experts or algorithm developers and operations professionals who are actually using the ML based application.

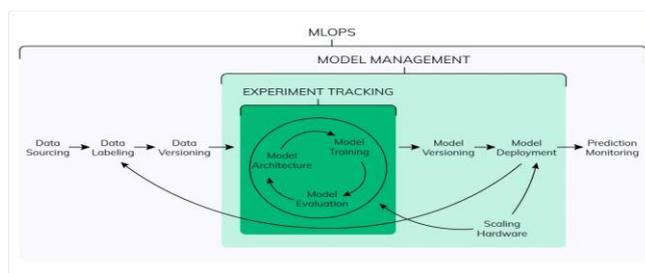


FIGURE 5. MLOps Based Models

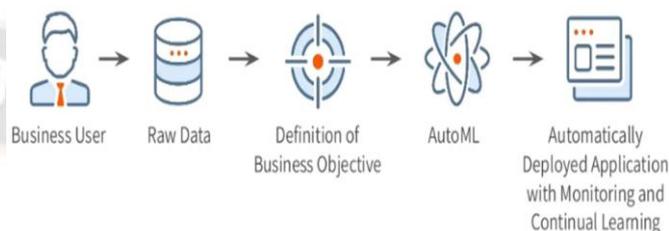


FIGURE 6. AUTOML MODEL

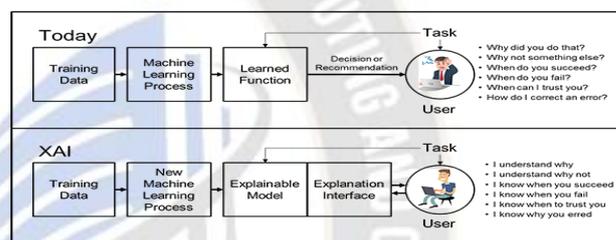


FIGURE 7. XAI Model

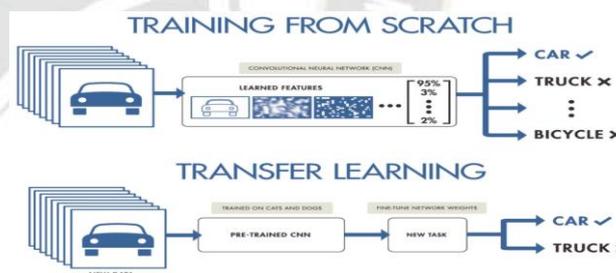


FIGURE 8. Transfer Learning Model

Applying MLOps practices as found in Figure 5, can increase the quality, simplifies the management process. MLOps also helps organizations to automate the ML and DL models deployment for large scale. End-to-end machine learning platform can be implemented using MLOps for performing cleansing of the existing knowledge assets, elimination of duplicate assets, validation of the knowledge assets such as research articles, and retrieving the important features of keywords from the research work which can be further used by the students or research community.

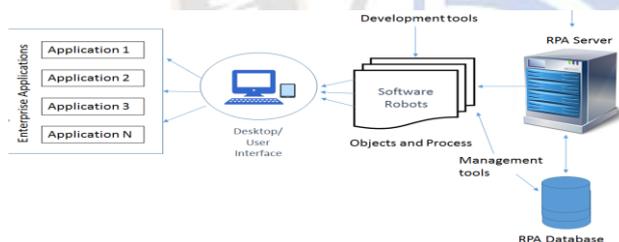
AutoML is the latest development in AI technology to automatically model or build ML processes for automating end-to-end ML based applications for real-world problems. AutoML also provides necessary and easy to use methods to

make ML available for non-ML experts for implementing efficiency of ML.

Transfer learning is a ML technique in which a model developed for a task can be reused or applied as the starting point for any second task for another model. It is an optimization technique to enable faster performance improvement while modeling any second or third task. It can be also referred to as multi-task learning to relate the similar problems and solutions for optimality. Figure 8 shows the differentiation between learning from scratch and transfer learning wherein the existing learning was transferred to the other task.

Robotic Process Automation (RPA) is the next generation AI technique to revolutionize any application or program through automation of tasks using robots or agents, mostly software programs. RPA provides better path ways to eliminate redundant knowledge assets, inefficiencies in the systems and enable full digitization [10].

RPA can assist faculties/researchers and students to provide timely information as well as helpful recommendations. RPA based solutions such as chatbots, software agents for KMS can reduce the processing time for collecting the smart learning contents/documents and finding the usefulness through the experts [11]. Figure 9 illustrates a simple RPA architecture how applications using software robots can be performed using RPA server and database. There is a need for further research to analyze and apply some of the latest AI based techniques such as MLOps, XAI, AutoML, Transfer Learning and RPA for their suitability and use for automating knowledge management processes[12-13].



**FIGURE 9.** RPA Model

## VI. CONCLUSION

AI Based smart agents allow educators, researchers to consolidate all the documents/knowledge assets automatically which will benefit from improved collaboration and communication through Web or smart devices. The proposed multi-model based agent system can maximize the use of educational resources in ways that directly benefit students, researchers and help them excel academically through proper search engines enabled with proper key words. The KMS can also be built with some dashboard for performance analytics and metrics, which can be added to rank/rate the knowledge assets present in the knowledge repository. Further research work will be carried out in selecting the right ML algorithms and Text Mining based algorithms for knowledge asset collections through the web based/intelligent agents. A composite multi-model More

research works will be carried out using AI based agents by applying RPA and AutoML for Automatic Knowledge collection, clustering, text mining and classification which would be continued further.

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