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Artificial Intelligence augmenting human intelligence in serving science and society: Integration of AI in Libraries.
A keynote address by
Basheerhamad Shadrach (bshadrach@col.org)
Director, Commonwealth Educational Media Centre for Asia
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Ladies and Gentlemen!

I am humbled to be invited to deliver a keynote at the prestigious LibWay 2024 conference being held in Berdsk of the Novosibirsk Region in Russia. I am thankful to Evgeniya Pshenichnaya (Evgenia Cheneknaya) who first invited me and remained a great friend encouraging me to take part in this event. It is due to her perseverance, I believe, most of us are here to attend this important event. Thank you, Evgeniya, for your efforts. I am pleased to also learn that the Libway 2024 edition has been dedicated to the 300th anniversary of the Russian Academy of Sciences.

The Academies of Science, and the likes, are one of the pillars of scientific advancement, often bridging the gap between science and society. At the global level, we understand that there are over 140 academies that operate at national or regional levels. There are attempts to forge inter-academy partnerships too. G20, in which your nation, Russia and my nation, India are members, for example, is an excellent platform for the Academia to talk to one another, preserve the ethos of science, innovate new pathways, and bring the benefits of science not just at the national level, but at large for humanity.

Your gesture of dedicating this year's Libway to the Russian Academy of Sciences is a great tribute to the Peter the Great who, together with Gottfried Leibniz, established this historical institution that continues to stand tall among its peers over the three centuries.

Libraries play an important role among the academia, in academic research and in helping to realise the objectives of the national academies such as the one established by Peter, the great. They forge partnerships across other academies, bring to the

attention of the national scientists of the advances made in other countries and more so, highlight the scientific efforts that lead to making this world a better place.

Libraries play such an important role of discovering knowledge, processing, and distilling that knowledge and more importantly, heralding the knowledge among one and all. The biggest service rendered is, as much libraries are helpful to the academicians, by highlighting and simplifying the content, they are helpful to the society that benefits from scientific advancement. Through the services of libraries, society can consume scientific knowledge in a simple manner. While serving the research community, the libraries also bridge the gap between research and society, thus being the interlocutors of lab to land!

How do we integrate AI in library services?

It may not be unfair to suggest that the main activities of library and information professionals (hereafter referred to as, knowledge workers) serving libraries is to fulfil Dr S R Ranganathan's five laws of library science:

- Books (Information and knowledge material) are for use
- Every person his/her book (information and knowledge material)
- Every book (information and knowledge material) his/her reader/user/learner
- Save the time of the reader/user/learner
- A Library/Information/Knowledge Centre is a growing organism

It is evident that the main role of the knowledge worker is to do the above; or, in other words, be the interlocutors between knowledge provider and knowledge seeker. In this pursuit, let us look at how the knowledge worker can exploit AI to augment his/her human intelligence. In doing this, I am likely to focus on the first law! The first law, which can be seen as the mother of the rest of the laws, refers to the role of knowledge workers to broaden access to knowledge material. Let us look at how this role was played by AI in the last three decades!

Sir Tim Berners-Lee proposed an information management system on 12 March 1989 while serving CERN (European Organisation for Nuclear Research) and implemented the first successful communication between a Hypertext Transfer Protocol (HTTP) client and server via the Internet in mid-November 1989. He devised and implemented the first Web browser and Web server and helped foster the Web's subsequent explosive development.

Robots.txt, a simple text file provided the handshake deal between whoever runs a website – big or small, an individual's blog or a huge corporate's website to tell the web who is allowed in and who is not allowed in. It determined which search engines can index the site, if one can grab the page and save onto their own systems and, simply,

functioned as a permit declaration. And, the search robots were called spiders, crawlers, worms, web ants, web crawlers, and the intentions of these were to build research databases, especially, meta-data elements of knowledge sources stored in one's own systems. This was the phenomenon and one of the developments soon after Sir Tim Berners-Lee, who I had the privilege to work with, opened the web to the world.

To prevent such a system, Martijn Koster and a few other web administrators wrote a simple code called *Robots Exclusion Protocol* which allowed websites to deny permission to all robots and to limit them. In other words, this text file allowed web developers to specify which robots were allowed to source meta-data or download the pages listed on their sites. And this has worked well for the past three decades, and the best use cases are Google, Bing and Amazon crawlers! The Internet Archives too used a crawler to store web pages for anyone's future use. Over half a billion websites had robot.txt file. Then, the Open AI arrived! And these fundamentally changed the way we access because these systems train large language models to crawl.

Today, with AI, we can use algorithms to enhance the efficiency and accuracy of knowledge retrieval. The mantra that "google will provide a thousand answers whereas a librarian will provide 'THE' answer" has been a good quote, but one is not sure to what extent, the statement was true all these days! It only denoted the fact that the human power was superior to the crawlers, while also recognising the fact that the human capability of crawling millions of websites was limited. Now with AI, by analysing vast amounts of data on one hand and the learners' behaviour on the other, we can find the right resources more efficiently and quickly – thus, realising one of the five laws – save the time of the user.

Saving the time and pointing to the relevant knowledge resources can be further strengthened and stretched with AI algorithms that the knowledge workers can today provide personalised recommendations. The knowledge professionals are better placed to use AI to analyse the browsing history, learner preferences, learner styles, learners' interests and their learning approaches in order to match those with the available knowledge resources so that the knowledge seeker is able to discover new resources. This also helps to promote the aspect of lifelong learning – a twist to the last law of library science. As much as the knowledge centre is a growing organism, the knowledge seeker is also a lifelong learner.

AI enables knowledge workers to manage their resources intelligently – as aspect articulated in the five laws – every knowledge material its user! Libraries can now automate the cataloguing processes, automate their digitalisation, automate their indexing work and organise knowledge more effectively through the use of AI and natural language processing.

AI helps to organise and streamline a range of administrative tasks undertaken by staff and assist in improving access to resources while also optimising one's own collection while depending upon collaborative mechanisms to broaden access to knowledge resources. It is also possible with AI to have demand predictions on the basis of the ongoing research undertaken by the clientele so as to be prepared for tomorrow with options of accessing material that are yet to be produced rather than being knowledgeable only about what is already available.

AI enabled virtual assistants and chatbots are already doing rounds in libraries and knowledge centres. A good number of FAQs and routine research questions are tackled by bots, offering round the clock support. Here, the knowledge seekers, knowingly or unknowingly, are trained in refining their prompts. Bots open up opportunities for the knowledge seekers to learn the prompting techniques, thus, be instrumental in building the prompting skills among the seekers – one of the information enquiry skills of the day!

AI enabled big data analytics based on the existing data, user generated data and knowledge centre specific data help us in decision making, especially by gathering insights into the utilisation of knowledge resources held in one's own knowledge centre as well as those accessed from external sources. These decision-making capabilities help to optimise and allocate budgets for on-site resources, subscriptions of publications and subscriptions of aggregated knowledge resources. The aspect of personalisation of knowledge access directly impacts one's own budget.

Finally, it may be stated that all the above AI-enabled actions also result in collaboration and resource sharing among knowledge centres as well as knowledge seekers. AI-powered platforms that the knowledge centres build can connect researchers with similar interest, facilitating not only multi-disciplinary but also trans-disciplinary research and collaboration, thus, fostering the original ethos of the scientific academies, such as the Russian Academy of Science that Peter the great envisioned. Ladies and gentlemen, thank you for your attention, and congratulations again on the 300th anniversary of the Academy and the great work of Libway 2024.