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AI and industrial engineering: History of a long partnership

By Adedeji B. Badiru

If we don't write our own IE story, no one else will write it for us. So let's give credit where credit is due. All the present hoopla about leveraging artificial intelligence in diverse areas is not new to the discipline of industrial engineering. I recall that in the incipient days of microcomputers, industrial engineering led the applications field through various theory and applications programs led by the late Dr. Gary E. Whitehouse of the University of Central Florida, under the auspices of the Institute of Industrial Engineers, which later became IISE.

The versatility of industrial engineering is encapsulated in its formal definition by IISE as "the profession concerned with the design, installation and improvement of integrated systems of people, materials, information, equipment and energy by drawing upon specialized knowledge and skills in the mathematical, physical and social sciences, together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems." This directly aligns with the past, present and future generations of AI, which is predicated on retrieval, permutation and combination of huge and diverse pieces of information; thereby requiring the assistance of computers.

You cannot have AI without the processing power of computers. What IEs conceived in the early days of AI (1956-1996) is now possible through present-day, high-power technology. We were hampered in those days by the limited RAM capabilities of desktop computers. In the early 1980s,

if you had 1 MB of RAM, you were in computing heaven. Despite those limitations, IEs still addressed practical problems in business, industry, education, law enforcement and the military.

One of the earliest demonstrations of this is the 1987 collaborative research by the University of Oklahoma IE Department and the Comanche County Sheriff's office that resulted in the publication of a nationally-celebrated article, "AREST: Armed Robbery Eidetic Suspect Typing Expert System" in the *Journal of Police Science and Administration* (Badiru et al, 1988). In that research, a team of IEs used early data analytics to draw inferences, conclusions and recommendations very much on the same template as the generative and predictive AI tools of today.

What we see in AI is nothing more than what IEs have been doing since the inception of desktop computers. The prevailing renewed emergence of AI is due to the emergence of new powerful computational tools and techniques. My call here is for IEs to put on their systems thinking caps and go out to spread the word about the long-running partnership between industrial engineering and artificial intelligence.

As far back as 1988, the *Computers & Industrial Engineering* journal published my article, "Expert Systems and Industrial Engineers: A Practical Guide for a Successful Partnership." Expert systems, as technical historians could recall, were the rudimentary levels of what we now call generative and predictive AI. One of the earliest applications-focused AI laboratories was established in the School of Industrial Engineering at the University of Oklahoma. The public stopped hearing about that legacy because we stopped making promotional noise about the value and far reaches of industrial engineering. Examples of AI/engineering systems products were developed at the University of Oklahoma in the 1980s-1995s.

One exciting development of that era resulted in an AI/ES tool named "OKIE-ROOKIE: An Expert System for Industry Relocation Assessment in Oklahoma." This was successfully deployed in 1991 to assess the potential for locating new industries in regions of Oklahoma.

A similar tool was later developed by the IE department at the University of Tennessee in Knoxville, in collaboration with the Blount County Visitor's Bureau, under the auspices of UT's Manufacturing Research and Development Institute and the Institute for Public Service. The collaborative research focused on computer-facilitated strategies for industrial development in East Tennessee. The documentation of that work is available on YouTube (*link. iise.org/badiru_mrdi).* This is a proud legacy of industrial engineering.

Other early AI/ES tools facilitated by IEs in the 1980s to 1990s included an integrated expert system with a fuzzy linguistic model for facilities layout; an application of AI in regional economic development; a knowledge-based expert system for robot consultancy; an expert system for external cylindrical grinding for manufacturing planning, diagnosing and training; a new computational search technique for artificial intelligence systems; and a template for the role of artificial intelligence and expert systems in new technologies.

There also were a fuzzy rule-based system for early fault detection and prediction (a good predictive AI of that generation); a fuzzy linguistic artificial intelligence model for assessing risks of cumulative trauma disorders of the forearm and hand; fuzzy inferencing approach to modeling and simulation; and a methodology for a real-time artificial intelligence surveillance system

The examples are the same AI-themed applications we are hollering about today. What we see in AI is nothing more than what IEs have been doing since the inception of desktop computers. The prevailing renewed emergence of AI is due to the emergence of new powerful computational tools and techniques. My call here is for IEs to put on their systems thinking caps and go out to spread the word about the long-running partnership between industrial engineering and artificial intelligence.

On a lighter yet serious note, my common quip with my family goes as follows: If I see a system that is working correctly and effectively, I say "it must have been designed by an industrial engineer." On the other hand, if I see a system that is not working as expected or as advertised, I say "they should have hired an industrial engineer to design it."

I hope this brief article will serve as an incentive for our professionals to write our own stories to disseminate and promote the legacy of artificial intelligence involvement and accomplishments. ❖

Note: For a full list of references used by the author, see *iise.org/isemagazine/references*.

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