SDS PODCAST EPISODE 750 FIVE-MINUTE FRIDAY: HOW A.I. IS TRANSFORMING SCIENCE

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This is Five-Minute Friday on How A.I. is Transforming Science.

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Welcome back to the SuperDataScience Podcast. I'm your host, Jon Krohn. Something that I'm going to do differently to start off today's episode that I got from my friends over at the Last Week in AI podcast, is going over recent reviews of the show on podcasting platforms. So we had two recent reviews in the past week on Apple Podcasts, one of them was from ATorb, which says that we're always on point, says that I always produce the show with care, they love that I ask questions that apparently ATorb is always thinking about. And that it's a high quality show. Thank you very much ATorb for your 5-star review.

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And also we got a 5-star review Chrispb15, so I don't know who this is exactly but they do say that they hope to one day be at point where they could be a guest on the podcast, so feel free to reach out on me, to let me know who you are, reach out to me on LinkedIn or Twitter, Chrispb15. And so Chrispb15 says that the show, the Super Data Science Podcast is their top in-depth AI source when they need to know something bottom-up and top-down, all the details of an AI topic, they search through over many episodes with foremost experts they say and thought-provokers on the cutting-edge of AI and find the episode that they need the most. They say that they became a believer in the show after the episode with David Foster, which was episode number 687.

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All right, thanks for those reviews and yeah, if anyone else out there listening happens to wanna make a review your favorite podcasting platform, that I guess somehow probably helps with growing the show and

I'd love to hear your feedback and yeah, I guess now I'll be reading it on air, something new that I plan on doing somewhat regularly.

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All right. Now into the episode content. So, today's episode is all about how A.I. is transforming science. So we're exploring the scintillating and groundbreaking role of A.I. in transforming the landscape of scientific research and discovery. From major recent breakthroughs to far-reaching implications in various scientific subfields, A.I. is proving to be not just a tool but a transformative catalyst for a new era of exploration and innovation.

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Exciting, all right so let's start at the Massachusetts Institute of Technology five years ago. 2019 was an extraordinary year at MIT because scientists discovered not one, but two antibiotics, one named halicin and another named abaucin, I guess, not sure if I'm pronouncing that correctly. But this discovery of two antibiotics is remarkable because, in recent decades, antibiotic discoveries have become quite rare; to discover two in one year globally is a huge feat, let alone in a single lab. Not only is this great news in the fight against dangerous antibiotic-resistant bacteria, but it's also encouraging because this new high rate of antibiotic discovery may become the new norm, thanks to A.I., or it could even be the beginning of an acceleration in antibiotic discovery. To go into a little bit of detail in what they were doing, the MIT researchers sifted through millions of compounds, training a ML model on known antibiotics as well as the efficacy of these antibiotics. This A.I.-driven method accelerated the usually lengthy drug discovery process, setting a new paradigm in pharmaceutical research. With any luck, this new A.I.-driven paradigm will reap gains not only in antibiotic discovery but in the pharmaceutical industry in general, the pharmaceutical industry needs this because drug-discovery has become excruciatingly slow and mind-bogglingly expensive in recent decades.

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One thing we can say for sure today is that the influence of A.I. in science extends beyond just pharmaceuticals and medicine. Fields like weather forecasting, materials science, and nuclear fusion are all harnessing A.I. to augment their research efforts. I've got some examples of all those coming up soon. Generally speaking, Google DeepMind's renowned co-founder Demis Hassabis, has likened A.I. to, something like the discovery or the invention rather of the telescope, so A.I. like the telescope is proving to be an indispensable tool that expands our understanding beyond natural limitations. And with the rise of deep learning in particular in the past decade, A.I. is democratizing research across disciplines, offering scientists a powerful assistant to navigate through complex data and equations.

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Here is an example. So consider the University of Liverpool's quest for new battery materials. Here, A.I. drastically narrowed down potential candidates from a staggering 200,000 materials for batteries to just five. Obviously, that's going to have a lot of [inaudible 05:05] savings, can make that kind of drastic reduction from 200,000 materials to just five of them. Similarly, Google DeepMind's, speaking of Demis Hassabis, their own AlphaFold algorithm is revolutionizing our understanding of protein structures, aiding in drug development and biological research. These examples illustrate A.I.'s ability to not only accelerate but also enhance the quality of scientific inquiry.

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Beyond helping scientists hone their focus on a small set of promising compounds as we've covered in the examples so far in this episode, A.I.'s predictive capabilities are also proving to be revolutionary, including for modeling the weather and climate. Innovations like Huawei's Pangu-Weather and Nvidia's FourCastNet, both of which I've provided links to in

the show notes, these innovations are delivering faster, more accurate forecasts, which is essential for understanding and responding to natural disasters quickly. And, perhaps the most exciting application area for me personally, given the abundant, clean energy it could deliver, is applications of A.I. to nuclear fusion. So, A.I. is playing a critical role in nuclear fusion advances by simplifying the control of plasma in tokamak reactors, this is a task that was dauntingly complex until recently, thanks to these A.I breakthroughs.

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Beyond helping scientists out, automation in research is another area where A.I. is building momentum. Consider, for example, self-driving laboratories, which I only recently discovered and I hope to focus on self-driving labs exclusively in an upcoming episode of the show. These self-driving labs are capable of planning, executing, and analyzing experiments all on their own and so they are transforming and accelerating scientific experimentation, while also opening up new avenues for discovery.

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Now how could an episode on how A.I. is transforming science be complete without a discussion of Generative A.I.? GenAI tools, such as OpenAI's GPT-4, Meta's Llama 2 and Google's Gemini, these are all another frontier, these are all providing another frontier, sorry, in scientific research. GenAI applications in science range from enhancing low-resolution images to designing new molecules, such as the examples we covered in Episode #738 with Pierre Salvy. This Generative A.I. approach is already yielding results, with several A.I.-designed drugs in various stages of clinical trials. Super super cool, that's a really fascinating episode, I highly recommend checking that out, 738.

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And perhaps a bit more obviously, the Large Language Models, the LLMs of GenAI are also reshaping how scientists engage with vast amounts of literature. Tools like Elicit, which I've got a link to in the show notes, are enabling faster, more efficient literature reviews, crucial for setting research directions. Moreover, the potential use of LLMs in simulating human behavior in research experiments could potentially revolutionize the field of social sciences.

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Of course, despite all the exciting advancements, A.I. applications to science still have limitations and so there are vast green fields for us still to explore. As an example, AlphaFold struggles with predicting the structure of certain types of proteins, underscoring that for some time A.I. will be a complement to human ingenuity, not a replacement for human scientists entirely. And this is because A.I. excels at interpolation but faces challenges in extrapolation beyond its training data, this underscores the need for ongoing human oversight and creativity.

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Despite these limitations, the role of A.I. in science is indisputably transformative. It's not just about doing things faster; it's about exploring new questions, uncovering hidden patterns, and pushing the boundaries of our understanding. So cool. As A.I. continues to evolve, its integration into scientific research promises to accelerate discoveries, enhance efficiency, and, most importantly, expand the horizons of human knowledge.

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All right, that's it for today. I hope you found today's episode to be inspiring. And maybe so much so that you feel like making a review on your favorite podcasting platform. Regardless, until next time, keep on rockin' it out

there and I'm looking forward to enjoying another round of the Super Data Science podcast with you very soon.