AR-BIC 2024: Real World Impact of AI

The 10th annual Arkansas Bioinformatics Consortium (AR-BIC) was held in Little Rock, Arkansas, February 26-27, 2024, with the theme, "Real World Impact of AI." Under the leadership of Dr. Weida Tong, Director of NCTR's Division of Bioinformatics and Biostatistics (DBB), the Scientific Program Committee organized a one-and-a-half-day program that included a wide range of presentations by speakers from diverse fields. This year's agenda featured four plenary presentations from renowned scientists, three pre-conference workshops, two roundtable discussions, four breakout sessions and a poster session. The conference also offered four categories of poster awards for postdocs, graduate students, undergraduate students, and most popular poster. This 10th anniversary event proved to be the most successful meeting in the AR-BIC history with the largest numbers of attendees (over 200) and poster presentations (over 60).

During the pre-conference workshops, attendees had a hands-on experience covering various data science and AI topics. In Workshop A, led by Dr. Stephanie Byrum, participants learned about cloud-based training modules and received a live demonstration of Biomedical Imaging Analysis. Workshop B, instructed by Dr. Russ Wolfinger and Dr. Wenjun Bao, showcased AI and machine learning applications in JMP Pro software, offering efficient model-building without extensive coding. Workshop C, facilitated by Nan Gabriel, focused on deep learning-based analysis using AWS Console, emphasizing genomics data analysis within an AWS environment. These sessions provided practical skills essential for leveraging cutting-edge technologies in data science and AI across diverse research domains.

The Plenary Session, chaired by Dr. Weida Tong, Director of the Division of Bioinformatics and Biostatistics at the National Center for Toxicological Research, US FDA,

offered a comprehensive exploration of the multifaceted intersections between AI and various domains of public health and biomedical research. Kicking off the session, Dr. Thomas Hartung, Director of the Center for Alternatives to Animal Testing at Johns Hopkins University, engaged attendees in an interactive Q&A session titled "The ToxAIcologist Is In – Ask Anything!" offering insights into alternative methods in toxicology research. Following this, Dr. Ruth Roberts, Director and Cofounder of ApconiX and Chair and Director of Drug Discovery at the University of Birmingham, UK, discussed the integration of data science in drug design to enhance safety considerations. After a brief break, the session resumed with Dr. Shuk-Mei Ho, Vice Chancellor for Research & Innovation at the University of Arkansas for Medical Sciences, delving into the potential and pitfalls of AI in public health, providing a nuanced perspective on its role in healthcare. Lastly, Dr. Li Shen, Professor and Deputy Director of the Division of Informatics at the Perelman School of Medicine, University of Pennsylvania, elucidated strategies for leveraging AI and informatics in enhancing dementia studies, emphasizing the importance of mining big biohealth data for advancing understanding and treatment of neurodegenerative diseases. Throughout the session, attendees gained valuable insights into the transformative potential of AI in addressing complex challenges across diverse domains of public health and biomedical research.

In Session 1 on AI for Analyzing Unstructured Data, chaired by Dr. Huixiao Hong from the National Center for Toxicological Research at the US FDA, experts congregated to explore the dynamic landscape of AI techniques in handling unstructured data. The session commenced with Dr. Wenjun Bao from JMP Statistical Discovery, SAS Institute Inc., presenting on the automatic text classification of drug-induced liver injury using document-term matrix and XGBoost. Subsequently, Dr. Fan Dong from the National Center for Toxicological Research

delved into the development of a BERT-based language model for extracting drug adverse events from social media, showcasing the potential of natural language processing in pharmacovigilance. Dr. Wenjing Guo, also from the National Center for Toxicological Research, then discussed strategies for enhancing the quality of drug terms in Rxnorm to empower AI for analysis of unstructured textual data, emphasizing the importance of data quality in AI applications. Lastly, Magnus Gray, also from the National Center for Toxicological Research, shed light on efforts towards robustly measuring bias in input embeddings, a critical step in ensuring the reliability and fairness of AI algorithms. Throughout the session, attendees engaged in lively discussions on advancing AI techniques and approaches to effectively analyze unstructured data, with a collective focus on leveraging AI's potential to glean meaningful insights and improve decision-making processes across various domains.

In Session 2 on AI Ethics: Considerations and Recommendations for Pursuing Positive Impact chaired by Dr. Leihong Wu from the National Center for Toxicological Research at the US FDA, attendees engaged in critical discussions surrounding the ethical dimensions of artificial intelligence (AI) deployment. The session commenced with Dr. Wu, presenting on concepts, measurements, and mitigations of bias in artificial intelligence, underscoring the importance of addressing bias to ensure equitable AI systems. Following this, Dr. David Barrett from the University of Arkansas delved into the intricate relationship between informational privacy and oppression, highlighting the ethical dilemmas inherent in AI-driven data processing. Dr. Zachary Stine from the University of Central Arkansas then emphasized the indispensable role of the humanities in shaping ethical AI development, advocating for interdisciplinary collaboration to address complex societal challenges. Throughout the session, participants exchanged diverse perspectives and insights, emphasizing the imperative of ethical

considerations in harnessing AI for the public good, thus setting the stage for continued dialogue and action in the realm of AI ethics.

Session 3 on AI in Informatics, co-chaired by Dr. Mary Yang and Dr. John Talburt from the University of Arkansas at Little Rock, showcased the transformative potential of AI across various informatics domains. The session commenced with Dr. Xiaowei Xu's presentation on OmniTrustAI, introducing a novel framework for revolutionizing AI with the "Train Once, Apply Anywhere" approach. Dr. Mariofanna Milanova further explored the intersection of human augmentation and generative AI for creative mastery, highlighting the art of possibility in AI applications. Dr. Juexin Wang from Indiana University delved into the realm of spatial omics with machine learning, demonstrating the synergy between AI and spatial data analysis. Lastly, Dr. Cesar Compadre from the University of Arkansas for Medical Sciences discussed the challenges and opportunities of AI in drug discovery, underscoring AI's pivotal role in advancing pharmaceutical research. Throughout the session, attendees gained insights into the diverse applications of AI in informatics, fostering collaboration and networking opportunities to harness AI's potential for driving innovations and addressing critical challenges in various informatics fields.

In Session 4 on Interpretable AI: Data Driven and Mechanistic Modeling chaired by Dr. Hao Zhu from Tulane University, attendees delved into the pressing need for interpretable machine learning (IML) models in computational toxicology. The session commenced with Dr. Fred Prior from the University of Arkansas for Medical Sciences presenting guidelines for trustworthy AI, followed by Dr. Ting Li from the National Center for Toxicological Research at the US FDA, who shared a case study on reproducible AI supporting regulatory applications. Dr. Alexandra Maertens of Johns Hopkins University then discussed the integration of human data

into chemical hazard assessments using AI methods. Lastly, Dr. Zhu wrapped up the session by exploring the significance of interpretable AI in data-driven modeling for chemical toxicity and drug safety evaluations, highlighting the advancements and future directions in the field. Throughout the session, the emphasis was placed on elucidating the underlying toxicity mechanisms and advancing the application of computational models in chemical risk assessments, reflecting the shared commitment to enhancing public health and safety through innovative AI methodologies.

Day 2 of the conference featured two significant sessions that provided valuable insights and discussions. The first session, "Dialogue with FDA Principal Deputy Commissioner and NIEHS/NTP Director," moderated by Dr. Tucker Patterson, Director of the National Center for Toxicological Research, US FDA, brought together Dr. Namandjé N. Bumpus, Principal Deputy Commissioner of the US FDA, and Dr. Richard Woychik, Director of the National Institute of Environmental Health Sciences (NIEHS) & National Toxicology Program (NTP), for an engaging dialogue. This session provided attendees with a unique opportunity to hear from key leaders in regulatory and research sectors, discussing current trends, challenges, and future directions of AI's impact on scientific research and regulatory applications. Following this, the panel discussion titled "Arkansas Bioinformatics Consortium (AR-BIC) – The Past, Present and Future," moderated by Dr. Weida Tong, Director of the Division of Bioinformatics and Biostatistics at the National Center for Toxicological Research, US FDA, featured esteemed panelists including Dr. William Slikker, former Director of the National Center for Toxicological Research, US FDA; Jerry Adams, former President of the Arkansas Research Alliance; and Dr. Shraddha Thakkar, Project Manager and Principal Investigator at the Center for Drug Evaluation and Research, US FDA. The panel provided a comprehensive overview of the AR-BIC's journey,

highlighting its achievements, ongoing initiatives, and future prospects, thus offering valuable insights into the evolving landscape of bioinformatics research and collaboration.

The 2024 AR-BIC conference brought together experts from diverse fields of science and technology to explore the latest advancements and challenges in AI, informatics, toxicology, and bioinformatics. Over the course of several sessions, attendees engaged in insightful discussions, interactive workshops, and informative presentations, covering a wide array of topics such as interpretable AI, data-driven modeling, AI ethics, and cloud-based training modules for data sciences. Keynote speakers and panelists shared their expertise, offering valuable perspectives on the application of AI in public health, drug discovery, and toxicological research. Additionally, attendees had the opportunity to participate in dialogue sessions with regulatory leaders, fostering collaboration and networking opportunities. The conference provided a platform for exchanging ideas, showcasing innovative research, and shaping the future of AI and informatics in advancing scientific discoveries and improving public health outcomes.