

Editorial

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Recent artificial intelligence (AI) developments are significantly impacting science and technology. In the area of biochemistry and molecular biology, AI tools can be used to (a) generate hypotheses, (b) design experiments, (c) analyze data, (d) write papers, (e) do drug research, (f) predict protein function, (g) predict metabolic pathways, (h) analyze medical records, and (i) design primers and probes.

(a) Generate hypotheses: Several AI tools have been designed to help generate hypotheses from large datasets and literature reviews. Here are a few notable ones:

HyperWrite's Hypothesis Generator: This tool helps create clear, concise, and testable hypotheses based on your research question and dataset.

Unriddle.AI: Known for its literature review capabilities, Unriddle.AI can also assist in generating hypotheses by analyzing and synthesizing information from a vast database of scholarly articles.

ResearchAgent: This AI-powered tool iteratively generates research ideas, problems, methods, and experiment designs based on scientific literature.

(b) Design experiments: AI tools can assist in designing experiments, predicting outcomes, and identifying potential variables. Here are a few notable ones:

IBM Watson Studio: This platform offers tools for data scientists, application developers, and subject matter experts to collaboratively and easily work with data. It

includes capabilities for designing experiments, predicting outcomes, and identifying key variables using machine learning and AI.

DataRobot: Known for its automated machine learning capabilities, DataRobot can help design experiments, predict outcomes, and identify important variables by analyzing large datasets.

Google Cloud AI Platform: This platform provides a range of tools for building, deploying, and managing machine learning models. It can assist in experimental design, outcome prediction, and variable identification through its advanced analytics and AI capabilities.

Microsoft Azure Machine Learning: This service offers a comprehensive suite of tools for building, training, and deploying machine learning models. It supports experimental design, outcome prediction, and variable identification through its robust AI and data analytics features.

(c) Analyze data: There are several AI tools that excel at analyzing large datasets, identifying patterns, and visualizing results. Here are few examples options:

Julius AI: This tool is designed to interpret, analyze, and intuitively visualize complex data. It supports various data formats and allows users to interact with their data through natural language prompts.

DataLab: An AI-powered data notebook that simplifies data transformation into actionable insights. It combines an

integrated development environment (IDE) with generative AI technology, making it easy to analyze data and generate comprehensive reports.

IBM Watson Studio: Known for its robust data analysis capabilities, IBM Watson Studio can analyze large datasets, identify patterns, and visualize results through its advanced AI and machine learning tools.

Google Cloud AI Platform: This platform offers a range of tools for building, deploying, and managing machine learning models. It excels in data analysis, pattern identification, and visualization.

Microsoft Azure Machine Learning: This service provides comprehensive tools for data analysis, including capabilities for identifying patterns and visualizing results through its powerful AI and data analytics features.

(d) Write papers: Several AI tools can assist you in writing papers, generating text, and summarizing results. Here are some of the options:

Grammarly: Known for its grammar and style checking, Grammarly also offers features for improving the clarity and coherence of your writing. It can help you generate text and ensure your papers are well-written.

QuillBot: This tool offers a range of features including paraphrasing, summarizing, and generating text. It's particularly useful for condensing large amounts of information into concise summaries.

Scribbr: Scribbr provides a free AI text summarizer that can condense articles, papers, and documents into key points. It's

designed to help with academic research by extracting essential information quickly.

ChatGPT: This AI model can assist in generating text, brainstorming ideas, and even writing entire sections of papers. It's versatile and can be used for a variety of writing tasks.

Jasper: Jasper (formerly Jarvis) is an AI writing assistant that can help generate content, write papers, and summarize information. It is widely used for content creation and academic writing.

(e) Drug discovery research: Several advanced AI tools can assist in predicting drug targets, designing new drugs, and predicting drug interactions. Here are some of the options:

PSICHIC: Developed by researchers at Monash University, this AI tool is designed for rapid and cost-effective drug discovery. It predicts the strength of interactions between molecules and proteins, which is crucial for identifying potential drug targets.

Exscientia: This company uses AI to accelerate the drug discovery process. Their AI platform, known as the 'Centaur Chemist,' helps in designing new drugs by computationally sorting through millions of potential small molecules to identify promising candidates.

DeepCPI, DeepDTA, and DeepAffinity: These deep learning-based tools are used for identifying drug targets and predicting drug-target interactions. They leverage large datasets to provide accurate predictions and insights.

IBM Watson for Drug Discovery: This platform uses AI to analyze scientific literature and data to identify new drug

targets and predict drug interactions. It helps researchers uncover hidden connections and generate new hypotheses.

(f) Predict gene function: AI can help predict gene function, identify potential gene variants, and predict gene regulation. These tools can significantly enhance research in metabolic engineering and systems biology. Here are few preferences:

Enformer: Developed by Google DeepMind, Enformer uses transformer models to predict gene expression patterns by understanding long-range interactions in DNA sequences. This tool excels in predicting gene function and regulation.

Eve (Evolutional model of Variant Effect): Created by researchers at Harvard and Oxford, Eve uses machine learning to analyze genetic variations across numerous species and predict the implications of these variations in human genes.

DeepCPI, DeepDTA, and DeepAffinity: These deep learning-based tools are used for identifying gene variants and predicting gene-target interactions. They leverage large datasets to provide accurate predictions and insights.

AI for Gene Promoter Prediction: This AI tool uses convolutional neural networks to predict the effectiveness of gene promoter sequences, which are crucial for gene regulation.

(g) Predict metabolic pathways: AI can help predict metabolic pathways, identify potential enzyme substrates, and predict metabolic flux. Following are some of the options:

BioTransformer 3.0: This web server uses machine learning and rule-based systems to

predict metabolic transformation products. It can identify enzyme substrates and simulate multi-step human biotransformation events¹.

Pathway Tools: Developed by SRI International, this software suite includes tools for predicting metabolic pathways and analyzing metabolic networks. It supports the creation of Pathway/Genome Databases (PGDBs) and provides visualization and analysis capabilities².

Deep Learning Models: Various deep learning architectures have been developed for metabolic pathway prediction. These models can analyze large datasets to predict metabolic pathways and identify key enzymes and substrates³.

(h) Analyze medical records: Several advanced AI tools can assist in analyzing medical records, identifying potential biomarkers, and predicting disease outcomes. These tools can significantly enhance research and clinical practice. Few options are given below:

IBM Watson for Health: This platform uses AI to analyze medical records and extract meaningful insights. It can help identify potential biomarkers and predict disease outcomes by leveraging vast amounts of clinical data.

DeepMind's AlphaFold: While primarily known for predicting protein structures, AlphaFold's technology can be adapted to identify biomarkers and predict disease outcomes based on genetic and proteomic data.

Enlitic: This AI tool analyzes medical images and clinical data to offer insights and predictions that support treatment planning. It is useful for identifying biomarkers and predicting disease outcomes.

Paige.AI: Focused on pathology, Paige.AI employs AI to assist pathologists in cancer diagnosis and prognostication. It helps in identifying biomarkers and predicting disease outcomes by analyzing pathology images.

the strengths of both AI and human intelligence.

(i) Design primers and probes: AI can assist in designing primers and probes for PCR, sequencing, and gene editing applications. Here are some notable ones:

PrimerQuest: This tool from Integrated DNA Technologies (IDT) allows for the design of highly customized primers and probes for PCR, qPCR, and sequencing. It offers extensive customization options to meet specific experimental needs.

ExonSurfer: A web-based tool designed to create primers at exon-exon junctions, ensuring specificity and accuracy in gene expression analysis.

BioTransformer 3.0: This tool uses machine learning to predict metabolic transformation products and can be adapted for designing primers and probes for various applications.

FBPP (Foodborne Pathogen Primer Probe Design): An open-source tool that provides a user-friendly interface for designing primers and probes, particularly for detecting foodborne pathogens.

Predict gene regulation: AI can help predict gene regulation, identify potential transcription factor binding sites, and predict gene expression.

In conclusion, it is important to note that AI tools can enhance human capabilities, however, they should be used in conjunction with human judgment and expertise to ensure decisions are ethical, creative, and adaptable. This balanced approach leverages