

June 2023

KEYWARD 'S AI ADOPTION

How Keyword Tackles AI Adoption
Challenges in Engineering: A Holistic
Solution

Introduction

In an era where data is the new gold, Artificial Intelligence (AI) has emerged as the alchemist, transforming raw data into actionable insights. Its integration into various sectors is revolutionizing workflows, and the field of engineering is no exception. The potential of AI in engineering is immense – from streamlining design processes to predictive analysis and beyond. However, the implementation of AI in this sphere doesn't come without challenges. In this discussion, we will explore how AI is poised to revolutionize engineering and the hurdles that can arise along the way. Moreover, we will present how Keyword is addressing these challenges, offering holistic AI solutions specifically tailored for the engineering sector.

How can AI revolutionize the engineering field?

Integrating Artificial Intelligence into engineering can substantially enhance productivity and efficiency. AI opens doors for innovative solutions, enabling predictive maintenance, optimizing designs, and automating complex tasks. Furthermore, AI can facilitate data analysis, thus leading to more informed and effective decision-making processes.

How can AI optimize the Design Evaluation cycle for 3D Computer Aided Design (CAD) products?

1. **Real-time Feedback:** AI systems can provide real-time feedback as designers work, identifying potential issues and suggesting improvements. This not only shortens the design cycle but also enhances the quality of the final product by allowing the designers to explore a wider design space in shorter period of time.
2. **Simulation and Testing:** AI can simulate a variety of real-world conditions and predict how the design will perform under each of these scenarios by several orders of magnitude faster than conventional Computer Aided Engineering (CAE) methods. Trained on real-world measurement data, AI can deliver good predictions for cases where simulations would fail.
3. **Generative Design:** AI can produce a wide range of design alternatives based on predefined criteria. Each design can be evaluated for its performance, allowing designers to choose the most optimal solution.

AI in engineering provides the same added value as in other fields → it boosts the productivity & the output of its users. For engineering companies, this means improved product quality and faster go-to-market.

The Implications of Incorporating AI in Engineering: A Closer Look at Challenges

The integration of Artificial Intelligence (AI) in engineering promises immense possibilities. However, the journey to seamless AI adoption is often not without its obstacles. Several categories of challenges arise, namely, data-related, technical, talent / skill-related, ethical, social, legal, and regulatory hurdles.

In this article, we delve into the primary trials posed by data, technical, and talent acquisition facets that organizations commonly encounter during the AI implementation process.

Navigating Data-related Challenges in AI Adoption

The journey of AI implementation is significantly influenced by the nature and quality of the data used. Four primary data-related challenges are recurrent in this process: data quality, data availability, data preparation, and data privacy and security.

- **Data Quality:** The accuracy, completeness, consistency, and distribution of data significantly affect AI model performance. Data quality is a fundamental pillar in the architecture of AI systems. A common adage among professionals in the field is "garbage in, garbage out," reflecting the reality that an AI system's effectiveness is intrinsically tied to the caliber of data it processes. Distortions in data, resulting from noise or inaccuracies, can disrupt the patterns an AI model is learning. Missing or inconsistent data can lead to biased or ineffective models, while inadequate data distribution can impede the model's ability to adapt to a variety of situations.
- **Data Availability:** Data availability becomes particularly challenging when dealing with sensitive and private data. Deep Learning models require big data sets comprising of thousands of data points which poses a challenge when dealing with engineering data. Unlike Language Models, which often utilize public data, engineering data is typically held within private sectors and can be scattered across various storage locations. This makes its retrieval and processing complicated many companies don't have an overview of all of their available data.
- **Data Preparation for AI:** The transformation of data into a format that AI can process is crucial. This process involves creating input data (such as parameters or shapes that a user would provide for predictions) and output data, which are the target values for prediction. To illustrate, the data preparation process for a Graph Neural Network that predicts a pressure field on a 3D shape's surface, involves a series of steps for input and output definition, including file loading, mesh processing, point cloud extraction, region of interest extraction, and data transferring.
- **Data Privacy and Security:** The management of sensitive data requires careful attention to ensure compliance with privacy and security regulations. Constraints regarding data type and volume can sometimes limit the data used for AI model training, making the task challenging.

Technical Challenges of AI Implementation in Engineering

The application of AI in engineering requires a comprehensive understanding of both the technical domain and the AI methods in use. In addition, the development and training of complex model architectures necessitate substantial processing power, posing a significant technical challenge.

Talent Acquisition and Skill-related Challenges in the AI Landscape

The fusion of engineering and data science demands a unique set of skills and this poses considerable talent acquisition challenges. Engineers, designers, and data scientists, equipped with a deep understanding of both technical domains, are in high demand, making it difficult for companies to recruit and retain such talent.

To address this, organizations are investing in the development of their existing technical staff, implementing training programs to enhance data science expertise internally. While this approach increases the pool of skilled professionals within a company, it is often time-consuming, costly, and raises concerns about talent retention.

Navigating the complex terrain of AI implementation is challenging, but an understanding of these hurdles can help companies prepare and strategize effectively. By overcoming these obstacles, organizations can truly harness the transformative power of AI in engineering.

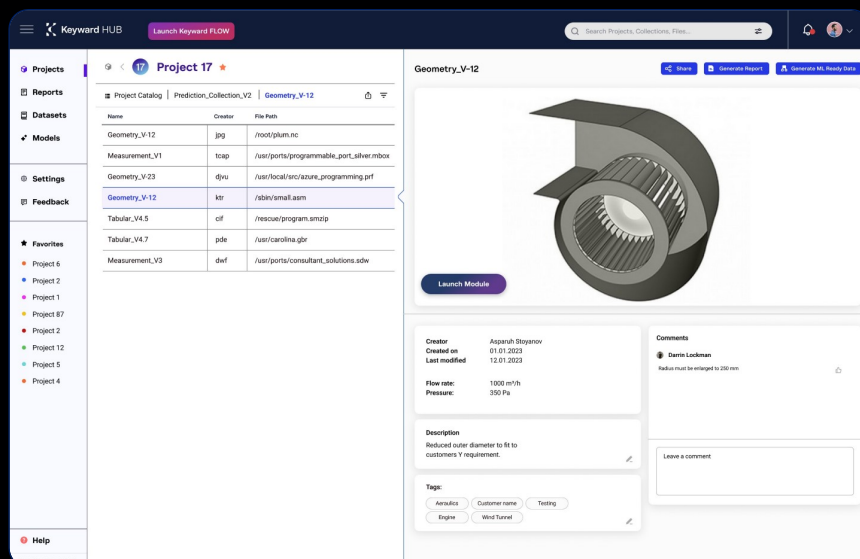
How Keyword Tackles AI Adoption Challenges in Engineering: A Holistic Solution

Addressing the multifaceted challenges posed by AI adoption in engineering, Keyword leverages its team of seasoned engineers to democratize the data preparation and AI development processes. Our aim is to create accessible avenues for engineers devoid of coding skills, streamlining their workflow and making the adoption of AI an effortless endeavor.

Keyword provides a comprehensive tool suite with Keyword HUB & Keyword FLOW, enabling seamless AI integration into your engineering workflows without the necessity of coding. This journey from raw data to a trained AI model involves several critical stages:

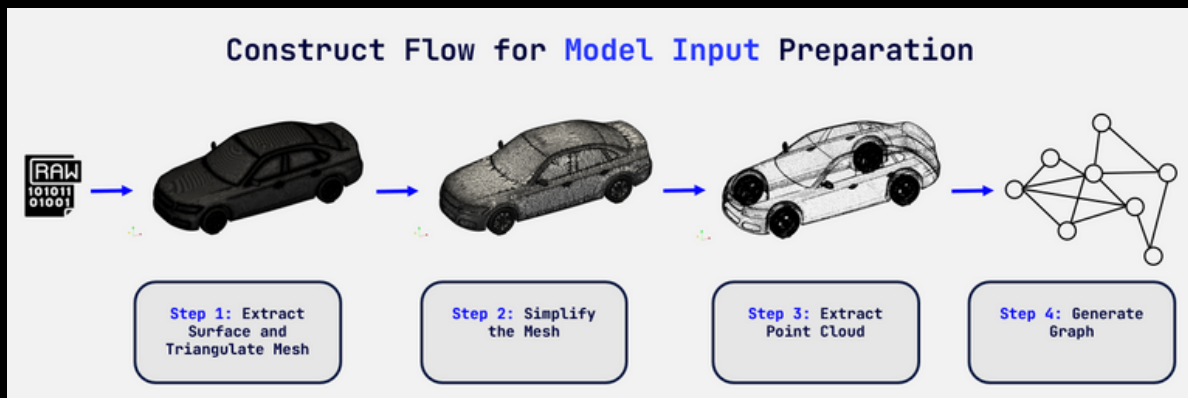
Keyword HUB

Automated Extraction of Quantities of Interest (QoI) in Keyword HUB: Our solution automates the extraction of performance data and metadata from existing simulation and measurement files. This eliminates manual effort and substantially reduces the time taken to extract Quantities of Interest — approximately 15 minutes per simulation file. The extracted data is organized into a centralized database, empowering users with a comprehensive overview of existing designs. Keyword's software supports various CAE data file formats (OpenFoam, Ansys FLUENT, and others) and standard tabular data formats like .csv, .xlsx, .json, and .hdf5.



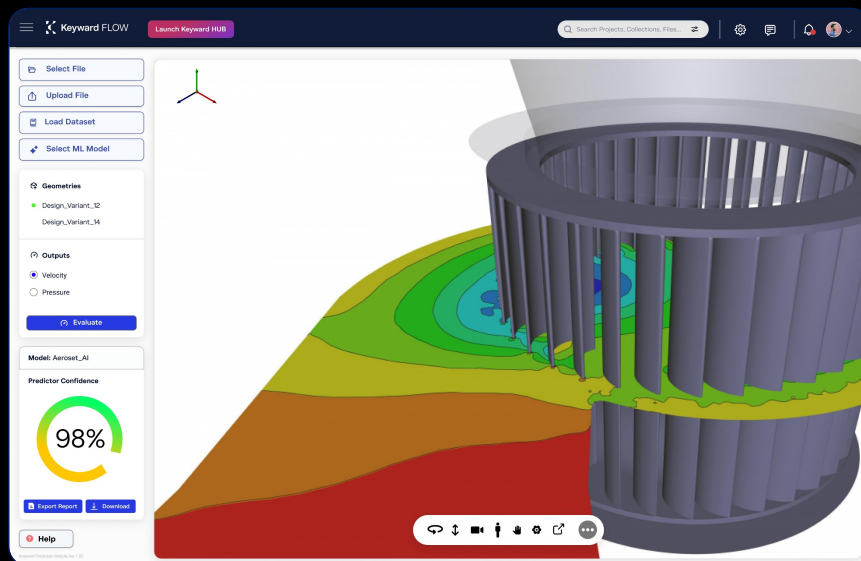
Exploratory Data Analysis (EDA) Tools in Keyword HUB: Our EDA tools are designed to aid users in exploring and assessing their data quality. Keyword HUB provides a multitude of data analysis features, including filters, histograms, correlation plots, regression models, clustering techniques, and correlation techniques. With just a few clicks, users can filter out outliers, categorize data clusters, and generate insights to facilitate informed decisions. These insights can be consolidated into a report and seamlessly shared with other stakeholders.

AI-ready Data Preparation in Keyword HUB: Keyword HUB features an automated tool for preparing data sets to train popular Deep Learning Architectures such as Autoencoders and Graph Neural Networks. Users can define the data processing pipeline, execute batch data processing, generate point cloud data sets with corresponding Quantities of Interest, and create Signed Distance Fields as a parameterization for the input shapes. All of these steps are facilitated through an intuitive user interface, requiring no code. Keyword is currently developing Data Fusion techniques to combine data from multiple multi-fidelity sources seamlessly. Furthermore, our cloud-native platform can dynamically scale resources to process data-intensive tasks.



Keyword FLOW

Training or Fine-tuning Pre-developed AI Models in Keyword FLOW: Our team of experienced data scientists, machine learning engineers, and CAE engineers are dedicated to refining state-of-the-art AI models. Users can select from a library of pre-developed models for training based on the available datasets. Moreover, Keyword offers pre-trained models for external vehicle aerodynamics, which customers can fine-tune. We're in the process of expanding our offering to include pre-trained models for other engineering use cases. Leveraging the benefits of a cloud-native platform, we ensure the seamless scaling of resources for optimal performance.



Conclusion

In summary, the integration of AI in the field of engineering has the potential to bring about a paradigm shift in the way we design and innovate. While there are significant challenges that must be addressed, companies like Keyword are at the forefront of these solutions, helping to streamline the adoption of AI in the engineering sector. By automating and simplifying complex processes and offering tools that support a diverse range of engineering workflows, Keyword is democratizing AI implementation, making it accessible to engineers, irrespective of their coding proficiency. With our continuous efforts in expanding our offerings and addressing the evolving challenges, we aim to unlock the full potential of AI, paving the way for the future of engineering.

**To test
Keyword's
platform,
contact us:**

www.keyword.io

info@key-ward.com

+33 686 410 480