This is the AI consultancy of the company TechHaven Solutions Ltd on the date 15.07.2024. This was a regular session facilitated by the expert Erik Lindström. TechHaven Solutions Ltd, based in Sweden, has exhibited a solid foundation in data analytics and software engineering, but their experience with AI applications is relatively limited, resulting in a current AI maturity level that is considered moderate.

The company’s objectives are well-defined and revolve around optimizing the design and manufacturing processes for custom-built machinery used in industrial settings. Their primary goal is to automate the generation of manufacturing drawings and specifications from 3D CAD models, particularly focusing on the detection and categorization of different machine components for efficient production planning. While their existing processes are efficient, they still rely heavily on manual input, particularly in reviewing and adjusting the 3D CAD models before finalizing the production specifications. For data acquisition, they use advanced CAD tools and have integrated some third-party software for initial processing, but the analysis and refinement of models remain largely manual with limited automation.

The concept of automating the analysis of 3D CAD models to generate production-ready specifications is practical and meets a significant market need. By integrating AI into their workflow, TechHaven Solutions Ltd can drastically reduce manual labor, speed up production timelines, and offer more competitive pricing to their clients. Implementing AI to automate the identification and categorization of machine components is essential for increasing productivity and ensuring consistent quality across different projects. The use of AI for CAD model analysis is particularly suitable, as it allows for the application of standardized rules and generalization across various machine designs.

While the company is focused on enhancing their product and service offerings, their long-term strategy for AI integration is still in the formative stages. However, they have identified their target market as industrial manufacturers and production firms, with a specific focus on companies requiring custom machinery. Regarding data requirements, TechHaven Solutions Ltd possesses a vast collection of 3D CAD models and associated manufacturing data from past projects. This dataset is invaluable for training and testing AI models to refine their automation processes. Data is continuously gathered as part of their design and production operations.

The company has shown commendable technical proficiency in utilizing CAD tools and in managing complex manufacturing processes. They also have strong capabilities in data analytics, though their expertise in AI remains somewhat underdeveloped. They are seeking technical guidance from FAIR Services for developing an AI-based proof-of-concept (POC) tailored to their specific needs. Although training requirements were not a primary focus during the consultation, it was noted that the company could benefit from specialized training in AI-driven CAD model analysis to bolster their expertise.

The experts suggested that the challenge of automatically generating manufacturing specifications from 3D CAD models could be approached either through rule-based systems that rely on existing CAD tools or through AI-driven systems that utilize deep learning models for component recognition and classification. For component recognition in CAD models, pre-trained models such as those available in the Open3D library can be explored. These models have demonstrated effectiveness in recognizing geometric shapes and features within CAD models, which is critical for automating the specification generation process. However, the performance of these models may depend on the complexity and variability of the machine designs.

The experts further recommended exploring the latest advancements in AI-driven CAD analysis, particularly in the context of automated design validation and optimization. For example, the research and code available from the CADLab at Stanford University offer valuable insights and tools for this domain. As discussed in the meeting, it is advisable to leverage both the geometric data from CAD models and the associated metadata (e.g., material properties, manufacturing constraints) to enhance the accuracy of AI-driven specifications. There is a growing body of research and tools available for multimodal analysis that combines geometric and non-geometric data in the CAD environment. Although adapting these tools to specific industrial needs might require some customization, the potential benefits in terms of automation and efficiency are substantial.

Starting with pre-trained models from established research papers was recommended. If these models show promise, they can be fine-tuned using TechHaven’s proprietary data to further improve their performance. Training models from scratch is generally not recommended due to the extensive resources required. Instead, a semi-automated approach could be pursued, where the AI model suggests component categorizations and specifications, allowing engineers to review and adjust these suggestions as necessary. This approach balances the advantages of automation with the need for precision and human expertise in the final production stages.