

PhD Project Proposal
Centre for Intelligent Autonomous Manufacturing Systems (i-AMS)
2019-2020

Proposed Project Title: Voice orchestrated design tools
Principal Supervisor: Dr Amar Kumar Behera
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Project description: <p>The next generation of collaborative and design-in-motion solutions calls for the integration of advanced vision and speech processing into current computer aided design (CAD) packages. Product definitions in CAD packages are tailored using design structures, such as Bills of Materials (BoMs), assembly mating conditions and function structures. However, due to different requirements of different divisions of a firm, and different lifecycle stages of a product, there are usually multiple definitions and their associated design structures within the same firm. This results in significant data management problems. In order to improve the sharing and management of design data across the firm, therefore, smarter ways to aggregate and cluster design data need to be evolved. One such technique that is being currently explored in academic research is that of embedding. Embedding enables superimposition of one mathematical construct on another. Methods of embedding that have been recently explored include the use of qualitative data analysis (QDA) tools and hyper dimensional lattices. This project will explore the use of voice orchestration in embedding design structures and also try to compare, contrast and amalgamate with the use of other techniques of embedding such as QDA tool and lattices.</p>
Aims and Objectives: <p>The aim of this project is to develop voice orchestrated design tools that enable embedding of design structures into engineering information such as CAD models, eventually materializing in integrated voice enabled product lifecycle management solutions. The objectives are listed as follows.</p> <ul style="list-style-type: none">• To perform a review of current techniques of voice integration in design tools• To understand the current techniques for embedding design structures in engineering information• To build a software interface for speech processing (text-to-speech and speech-to-text)• To integrate the speech processing software prototype with a current CAD tool such as SolidWorks• To explore the feasibility of incorporating large vocabulary continuous speech recognition (LVCSR) within the software interface• To use deep learning techniques to facilitate real time speech recognition• To create acoustic and dialogue models based on speech data in engineering design user contexts involving conversations between novice and expert engineers• To use psycho-acoustical methods that improve speech recognition• To embed BoMs and function structures into CAD models using the developed speech processing software tool• To develop apps for integrated design-in-motion and product lifecycle management solutions that can be launched on the Apple App Store and commercialized
Key skills required for the post: Mechanical design, Programming (preferably MATLAB, C++/C#/Python)
Key transferable skills that will be developed during the PhD: Digital signal processing, project management, artificial intelligence
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