

# V L K BHARADWAJ MANDA

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## EDUCATION

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### Indian Institute of Technology Madras (IITM), Chennai

July 2016 – Jan 2022

MS + PhD | Direct PhD

- PhD Thesis Title: “Deep learning frameworks for the classification, search and retrieval of 3D Engineering models”
- MS Thesis Title: “A k-d tree based deep learning approach for part-based segmentation of 3D Point Clouds”
- CGPA: 8.00/10
- Relevant coursework: Advanced Data Structures and Algorithms, Advanced Programming Laboratory, Mathematical Foundations for Data Science, Artificial Neural Networks, Applied Linear Algebra, Optimization Methods for Engineering Design, CAD/CAM for Product Design

### National Institute of Technology Tiruchirappalli (NITT), Trichy

July 2012 – May 2016

B. Tech | Computer Science and Engineering

- CGPA: 8.50/10

### Mahathi Junior College, Visakhapatnam

March 2012

Board of Intermediate Education, Andhra Pradesh | Class XII

- Percentage : 96.1%

### Kotak Salesian School, Visakhapatnam

March 2010

Indian Council for Secondary Education (ICSE) | Class X

- Percentage: 92.71%

## EXPERIENCE

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### Senior Data Scientist, Caterpillar Inc., Chennai

March 2022 – present

Procurement Analytics Team | Strategic Procurement & Planning Division

### Teaching Assistant, IIT Madras, Chennai

July 2016 – July 2021

- Course ED1021- Introduction to Computation and Visualization (Theory + Lab) Jan 2021 – May 2021
- Course ED2090- Geometric Modelling & CAD (Theory) Jan 2020 – May 2020
- Course ED5310- Differential and Computational Geometry Jan 2018 – May 2018
- Course ED1021- Introduction to Computation and Visualization (Theory + Lab) Jul – Nov 2016, 17, 18, 19

### Research Assistant, IIT Madras, Chennai

July 2016 – March 2022

Advanced Geometric Computing Lab | Advisor: Prof M Ramanathan

- As a Research Scholar, I have worked on developing frameworks for deep learning (DL) based classification, search and retrieval of 3D engineering CAD models. Since deep learning solutions are data-driven, my work introduced two annotated datasets ‘CADNET’ and ‘CADSketchNet’. Consequently, efficient feature representation methods and network architectures are developed. A deep learning approach, SketchCleanNet, is also introduced to clean query sketches of 3D CAD models, to better the search results.

## INDUSTRIAL PROJECTS

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### SIEMENS-IIT Madras, Chennai

July 2021 – Feb 2022

Part-Time Researcher

- Project Title: Futuristic Product Life Cycle Management framework - Interpretable, inter-operable and interactive PLM (i3PLM)
- Worked on developing an AI-enabled search engine for 3D CAD models of engineering components. Developed a Siamese Neural Network model that yielded the best retrieval performance.

## RESEARCH PROJECTS

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### Deep learning approach for enhancing 3D CAD model sketches

May 2021 – Dec 2021

Advisor: Prof. M. Ramanathan, IITM

- Developed a first-of-its-kind deep learning strategy to clean/enhance the query sketches of 3D CAD models. Introduced a novel scheme to calculate error that uses the idea of pixel probabilities. The enhanced sketches offer improved search results by at least 2%.

### Deep learning framework for sketch-based retrieval of 3D CAD models

Feb 2019 – Jan 2021

Advisor: Prof. M. Ramanathan, IITM

- Created a dataset 'CADSketchNet' which contains query sketches corresponding to 58,696 3D CAD models. For this, a weighted combination of canny edge detection and Gaussian blurring was used. Using this data, trained various deep learning based search engines, where a Siamese Network based approach yielded best performance.

### Deep learning based Classification of 3D CAD Models

April 2018 – Aug 2020

Advisor: Prof. M. Ramanathan, IITM

- Developed a first-of-its-kind approach for classifying 3D CAD models using Convolutional Neural Networks (CNNs). Created a dataset 'CADNET' containing 3,317 3D CAD models with class annotations, and used it to train a CNN using residual connections. Developed a view-weights scheme using machine learning to calculate relative weights of viewing directions of CAD models. This approach was able to get state-of-the-art classification accuracy of 95.63%

### A k-d tree based deep learning approach for part-based segmentation of 3D Point Clouds

March 2017 – Feb 2019

Advisor: Prof. M. Ramanathan, IITM

- Segmentation is done on an order-invariant representation of the input point cloud. This representation is obtained by constructing a k-d tree for the point clouds. The output is fed into a fully-convolutional network with skip connections. A separate network is trained for each category. The network is trained on a subset of ShapeNetCore containing 16,880 models from 16 shape categories. The results of this work are sent to the ShapeNet Segmentation Challenge, as part of the ICCV 2017 workshop.

### An Elegant Home Automation System Using GSM and ARM-Based Architecture

March 2015 – October 2015

Advisor: Prof. N. Ramasubramanian, NIT Trichy

- The proposed research provides a cost-effective home automation system that helps know and control the status of different home appliances. The technology here is the Global System for Mobile Communication (GSM), and the central processing unit of this system is the NXP LPC11U24 microcontroller unit (the ARM "mbed" microcontroller), which is designed especially to prototype low-cost Universal Serial Bus (USB) devices and other applications that are battery powered.

## AWARDS & ACHIEVEMENTS

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### The Graphics Replicability Stamp Award

Aug 2021

- The Graphics Replicability Stamp Initiative (GRSI) promotes reproducibility of research results and allows researchers to immediately benefit from state-of-the-art results, without the need to re-implement the proposed algorithms.
- Awarded the Stamp for making the dataset - 'CADSketchNet' - An Annotated Sketch dataset for 3D CAD Model Retrieval with Deep Neural Networks - available to researchers for free, non-commercial use

### Selected for Overseas Visiting Doctoral Fellowship | SERB, Govt. of India

Aug 2020

- The OVDF scheme provides opportunity to performing Indian research students to gain exposure and access to top class research facilities in academia and labs in specific Overseas Universities.
- I was one among the 25 students selected across India. Selected to pursue Research at Purdue University, USA

### Awarded the AIEEE / JEE TOPPERS SCHOLARSHIP | MHRD, Govt. of India

Jul 2012 – May 2016

- Scholarship awarded to AIEEE/JEE toppers (Top 2000 All India Rank Holders) who choose to join NITs. I have received the scholarship through all 4 years of my B. Tech, having joined NIT Trichy with an AIEEE Rank of 1205.

## SKILLS & COMPETENCIES

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- **Programming** – C, C++, Python, HTML, MySQL
- **Tools** – MATLAB, MeshLab, Autodesk Fusion 360, LaTeX, Snowflake
- **OS** – Windows, Linux, MacOS
- **Packages** – OpenCV, Sklearn, Open3D
- **Languages** – English, Telugu, Hindi

## PUBLICATIONS

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1. **[Under Review] Manda B.**, Kendre P., Dey S., Muthuganapathy R. "SketchCleanNet - A deep learning approach to the enhancement and correction of query sketches for a 3D CAD model retrieval system." Computers & Graphics Special issue on 3D Object Retrieval (2022)
2. **Manda B.**, Dhayarkar S., Mitheran S., Viekash V K., Muthuganapathy R. "CADSketchNet-An Annotated Sketch dataset for 3D CAD Model Retrieval with Deep Neural Networks." Computers & Graphics 99, Special issue on 3D Object Retrieval (2021): 100-113. doi: <https://doi.org/10.1016/j.cag.2021.07.001>
3. **Manda, B.**, Bhaskare P., and Muthuganapathy R. "A Convolutional Neural Network Approach to the Classification of Engineering Models." IEEE Access 9 (2021): 22711-22723. doi: <https://doi.org/10.1109/ACCESS.2021.3055826>
4. **Manda, VLKB**, Voona K., and Natarajan R. "An elegant home automation system using GSM and ARM-based architecture." IEEE Potentials 37.5 (2018): 43-48. doi: <https://doi.org/10.1109/MPOT.2016.2515644>