

# SIVA VIGNESH KRISHNAN CHIDAMBARAM

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## EDUCATION

2017 - 2021	B.Tech. Major: <b>Mechanical Engineering</b> , Minor: <b>Mathematics &amp; Computing</b> Indian Institute of Technology (IIT) Kharagpur, India	CGPA: 9.02 / 10 <a href="#">Transcript</a>
March 2017	All India Senior Secondary Certification Examination (CBSE) Vishwa Sishya Vidyodaya, Pollachi, India	Percent: 96.4% <a href="#">Certificate</a>

## AREAS OF INTEREST

Robotics | Optimal Control | Optimization | Path Planning | Reinforcement Learning | Biomimetics | Machine Design

## PUBLICATIONS

- Amit Kumar Das, Ankit Kumar Nikum, **Siva Vignesh Krishnan**, Dilip Kumar Pratihar, "Multi-objective Bonobo Optimizer (MOBO): an intelligent heuristic for multi-criteria optimization", Knowl Inf Syst (2020) ([Published](#))
- Siva Vignesh Krishnan**, Vimlendu Singh, Poojan Shah, et al, "Development of an RFID-Based Semi-Autonomous Robotic Library Management System" in 4th IEEE ICACR 2020, Rome, Italy ([Published](#))
- C.D'Ettore, N.N.Dei, **S.V.Krishnan**, S.Zirino, G.Chalvatzaki, A.Stilli, D.Stoyanov, "Flexible Framework for Reinforcement Learning in Surgical Robotics" in 10th CRAS 2020, Barcelona, Spain ([Accepted Preprint](#))

## INTERNSHIPS

### Reinforcement Learning Framework for Tele-Surgical Robotics

Apr 2020-Jul 2020

Mentor: Dr. [A Stilli](#), WEISS, University College London

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- Modularised the simulation environment (dVRL) of the daVinci surgical robot by building a model in PyRep
- Built a ROS Node for recording demonstrations from the dVRK master console to overcome explorations in RL
- Recorded demonstrations from CoppeliaSim to learn a policy using Deep Deterministic Policy Gradient (DDPG)
- Employed the learned policy to pick the Pneumatically Attachable Flexible Rail and place it on the target organ

### Multi-Objective Bonobo Optimizer (MOBO) - a Heuristic for Multi criterion Optimization

May 2019-Jul 2019

Mentor: Prof. [D K Pratihar](#), Soft Computing Laboratory, IIT Kharagpur

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- Developed 3 algorithms, inspired from social behaviour of Bonobos, to solve multi-objective problems in MATLAB
- Employed techniques-non dominated sorting & grid indexing; ranking scheme crowding distance; decomposition
- Analyzed the results of the algorithms obtained when tested on 30 benchmark problems using standard metrics

## RESEARCH EXPERIENCE/PROJECTS

### Vector-Field Based Waypoint Following in 2D

Jul 2020-Present

Bachelor's Thesis Project | Mentor: Dr. [Sikha Hota](#), IIT Kharagpur

[Report](#)

- Implemented a Lyapunov Guided Vector Field based algorithm for waypoint following ensuring C1 continuity
- Compared the proposed algorithm with quintic Bezier curves and G2CBS algorithm from the literature
- Currently, designing a model predictive controller to track the generated path, ensuring smooth maneuver

### Autonomous Vision Based Pipe Climbing Robot

Sep 2019-Present

Undergraduate Researcher | Mentor: Dr. [D K Pratihar](#), IIT Kharagpur

- Developing a mobile robot to inspect and paint pipes in industries which are difficult for manual operations
- Designed a 5 DOF manipulator with two grippers which are connected by four links and five revolute joints
- Solved the kinematics and inverse kinematics problem by fixing one gripper in MATLAB

### Kharagpur Hyperloop Research Group

Mar 2019-Present

Team Manager & Co-Founder | Mentor: Dr. [Aditya Bandopadhyay](#), IIT Kharagpur

[Report](#) | [Brochure](#)

- Designing and fabricating a Hyperloop pod with an aim to compete in the SpaceX Hyperloop Pod Competition
- Mustered financial (USD 7000) and workspace support from MN Faruqui Innovation Centre, IIT Kharagpur ([Video](#))
- Modelled the relationship between BLDC motor RPM and desired levitation height in EDW mechanism
- Designed a controller for synchronising the speed of two BLDC motors used while carrying out experiments

- Intelligent Picking Robot** Jul 2020-Present  
[Report 1](#) | [Report 2](#)  
**National Finalist | Flipkart's Grid 2.0 - Robotics Challenge**
- Proposed a 6-DOF gripper and developed an algorithm based on Becchi's criteria for form closure to pick objects
  - Tested the algorithm for grasping on preprocessed point cloud data of different household objects [\[Video\]](#)
  - Established the D-H parameters & generated end-effector trajectories for 6-DOF manipulator with a reach of 2 m
- Terrace Farming Robot for Hilly Areas (Bagged First Place)** Oct 2019-Dec 2019  
[Report](#) | [Video](#)  
**8th Inter IIT Tech Meet, Roorkee | Mentor: Dr. Aditya Bandopadhyay, IIT Kharagpur**
- Designed an autonomous robot with integrated mechanism for ploughing, seeding and rolling operations in series
  - Developed a two cross scissor-lift mechanism for climbing and a novel module for harvesting and irrigation
  - Optimized the linear actuator force to obtain the desired vertical stroke length (40 cm) of the bot
- Semi-Autonomous Book Organizing Robot in a Library** Jan 2019-Apr 2019  
[Report](#)  
**Hardware Modelling, Intra-Collegiate General Championship - 2019, IIT Kharagpur**
- Designed the CAD model of scissor-lift riser subsystem and book holder & separator subsystem in SolidWorks
  - Devised a four wheel skid steer driving mechanism and performed necessary calculations for the bot's locomotion
  - Implemented PID control loop on magnetostators and Encoder Motors for motion using Raspberry Pi & Arduino
- Vrishabh - a Robotic Solution for Agricultural Warehouse Management** Sep 2020-Oct 2020  
[Report](#) | [PPT](#)  
**Tata Innoverse**
- Proposed an RFID-based guided path planning and navigation scheme for the robot to move in the warehouse
  - Designed the pedestal to serve as a housing for various components and as a mount for the 8 DOF manipulator
- Tarang - a new Electrolyte Based Long Range Battery System** Jan 2019-Feb 2019  
[Report](#)  
**Product Design, Intra-Collegiate General Championship - 2019, IIT Kharagpur**
- Proposed a hybrid battery system - Vanadium Redox Flow Battery (Primary) and Aluminium-air battery (Secondary)
  - Designed a polygon shaped battery pack for aluminium air battery with 30% increase in packing efficiency
  - Performed the necessary calculations for battery efficiency- 95% and battery recharging time- 5 mins for 100 km

## TECHNICAL SKILLS

Languages	C++, Python (stable_baselines, TensorFlow, sklearn, OpenCV, numpy, pandas), $\LaTeX$
Robotics	ROS, CoppeliaSim (V-Rep), Gazebo
Softwares & Tools	MATLAB, Simulink, SolidWorks, Fusion 360, Ansys, Ultimaker Cura, COMSOL, EES
Hardware Programming	Arduino and AT-Mega microcontrollers, Raspberry Pi

## ACHIEVEMENTS

- 2020** [Qualified](#) for National Finals in Flipkart's Grid 2.0 by markedly being in top 9 among 1500 teams
- 2019** [Won first place](#), representing IIT Kharagpur, in the robotics event against 23 IITs at the Inter-IIT Tech Meet 8.0
- 2018** Secured a Department Change to Mechanical Engineering from Aerospace Engineering with CGPA 9.56/10 by being among top 0.5% of the freshmen batch of 2017-18
- 2017** Ranked in National Top 0.4% (amongst 1,200,000 candidates) in JEE Mains, 2017 Examination
- 2017** Awarded a certificate of merit from CBSE for outstanding performance and being among the National top 0.1% of successful candidates in AISSCE - 2017 in the subjects Computer Science and Chemistry

## RELEVANT COURSEWORK

Control Courses	Robotics Courses	Mathematics Courses	Computer Science Courses
Automatic Control	Robotics (NPTEL) *	Probability & Statistics	Image Processing
Systems & Control	AI for Robotics *	Linear Algebra	Basic Electronics
Transform Calculus	Reinforcement Learning *	Computer Networks	Data Structures
<a href="#">Control of Mobile Robots</a> *	<a href="#">Deep Learning</a> *	Real Analysis	<a href="#">Machine Learning</a> *

**Core Courses** - Design Optimization | Kinematics & Dynamics of Machines

\* - online courses

## EXTRA-CURRICULAR ACTIVITIES

- Leadership** - Lead the Hardware Modelling team of Patel Hall, IIT Kharagpur as [vice-captain](#) - 2019 & 2020
- Management** - Managed a budget of INR 89000 as [Technology Events Secretary](#) of Patel Hall, IIT Kharagpur
- Student Mentor** - responsible to assist 6 freshmen from this year under the Dean of Student Affairs, IIT Kharagpur
- Volunteer** - National Service Scheme, Kharagpur - 170+ hours of social work - Increased awareness about education in Kharagpur region; Facilitated Blood Donation Camp at Patel Hall for the years 2018 and 2019
- Cultural** - Participated in Ek Bharat Shreshtha Bharat-2018, IIT Kharagpur, an initiative Government of India