# Dhruv Sheth

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## Education

- **Pace Junior Science College** — Mumbai, India
  *Higher Secondary Schooling - Physics, Chemistry, Math and Computer Science, Grade - 95%* — *2021 - 2023*
  ***Courses:***
  1. *Physics: Topics taken: Mechanics, Electricity and Magnetism, Fluid Mechanics and Thermal Physics, Oscillations and Waves, Optics, Modern Physics.*
  2. *Chemistry: Topics taken: Physical Chemistry, Organic Chemistry, Inorganic Chemistry further divided into chapters.*
  3. *Mathematics: Topics taken: Calculus, Co-ordinate Geometry, 3D Geometry and Vectors, Algebra, Trigonometry*

- **Udayachal High School** — Mumbai, India
  *Secondary and Elementary Schooling, Grade - 95.4%* — *Grad - 2021*
  ***Activities:***
  1. *National Science Olympiad, SOF International Mathematics Olympiad, NELTAS E-CAT Examination, Natural Science Olympiad, HBBVS Examination, School Representative at Annual Regional and State Science Fair (6th, 7th, 8th and 9th Grade), Volunteer at Adolescent Health Champions, School Editor team, Member at Pioneers Club and Environmental Club.*

## Skills Summary

- **Languages**: Python, C++, MATLAB, Wolfram Language
- **Frameworks**: Tensorflow, Keras, Pytorch, YOLO, OpenCV, OpenVINO, DepthAI, MobileNet, Deeplab v3+, Blazepose, VanillaNet, PGGAN, EfficientNet, Resnet50, SqueezeNet, MaskRCNN FRCNN
- **Tools**: Latex, GIT, AutoCAD, Fritzing, Excel, Tableau
- **Platforms**: ROS, Mbed OS, Arduino, FPGAs, Jupyter Notebook, Kepler.gl, Particle IDE, EdgeImpulse, Wordpress, Elementor, Raspbian

## Experience

- **Schepens Eye Research Institute (SERI), Harvard Medical School** — Remote
  *Student Researcher at Gang Luo's Lab working directly under Prof. Ayush Kumar* — *Jan 2022 - Present*
  - **ML based eye-gaze pattern assessment in Hemineglect people**: Developing Spatial Perception and Navigation Algorithms to identify gaze pattern and assessing other quantitative measures in people with Hemispatial Neglect. This research utilizes Object Detection, Tracking and Segmentation algorithms to quantify the nature of data gazed and patterns in gaze which are analysed through temporal gaze graphs. Working directly under Prof. Ayush Kumar and reporting and conducting research with Dr. Shrinivas Pundlik and Dr. Gang Luo for their input in the ophthalmology domain of the Research.
  - **Generative Adversarial Network for eye-gaze dataset augmentation**: Working on developing a Generative Adversarial Framework with a novel discriminator algorithm to augment eye gazes in synthetic datasets to convert them to real images for development of accurate eye-gaze estimation models based on the Unity-Eyes Synthetic dataset. This research will be submitted to ETRA 2023 later this year.
- **Luxonis Corp.** — Remote
  *Community Research Intern* — *March 2021 - October 2021*
  - **Employer - Brandon Gilles**: Worked with the community on custom-use case development and implementation. Apart from this, developed the DepthAI API to develop algorithms and integrate Spatial Perception to Computer Vision Models, using the OpenVINO model framework. During this period, worked on several open-source Github repositories affiliated to DepthAI including SLAM, OpenCV Integration, Intel Realsense Integration, several Frameworks including Semantic Segmentation and Re-identification and Spatial information integration with tracking and provided necessary feedback for the improvement of OAK-D device. Worked and reported directly under Brandon Gilles. Additionally, worked with a Startup as a Luxonis Representative on "StreetSense", currently scaled to an Enterprise Scale. Finally, during the course of the internship, developed HapticCV, a device to alert bicylists using haptic signals in situations including overtaking or potential accidents which is in the process of commercialisation.
- **EdgeImpulse** — Remote
  *Research Intern and Ambassador* — *Jan 2021 - Present*
  - **Employer: Jan Jongboom, Adam Benzion**: Worked with colleagues remotely on Embedded Systems, quantization of ML models (largely MobileNet), and also was a significant contributor to EON Tuner with Daniel Sitayunake, which received the Best Edge AI Developer Tool at Edge AI and Vision Alliance. Over the course of time, worked with ARM, Sony, Seeed, Particle, Hackster, Irnas Institute, Raspberry Pi, Himax as an EdgeImpulse representative and developed Enterprise-grade projects using the development board sponsored by these organisations. Presented at conferences such as TinyML Asia 2021 and IPSN 2022 over the Research conducted at EdgeImpulse.
- **Neosensory Inc.** — Remote
  *Community Research Intern* — *November 2021 - Present*
  - **Working under Dr. David Eagleman and Jennie Stenhouse**: Continuation of the Research on HapticCV which was awarded the Grand Award at 'Feel the Future' Neosensory contest and hardware to accomplish the project in the term as an inern at Luxonis Corp. is further continued with plans to commercialize. This Research project is the core of the group at Neosensory Community Research program where a team involving Graduates and Post-docs including me work on trying to commercialize the Research as well as improve the algorithms on the haptic spectrum.

- **Schemobotics.com** Mumbai, India
  *Founder and Developer* *November 2019 - November 2021*
  - **E-commerce platform for Robotics**: An E-commerce platform for Electronic components, Robotics and Development boards. Initially started as a side venture to fund components required for my Research, however gained traction over time. A total profit of $750 earned throughout the period utilised in funding Development boards to work on my Research. Pitched to Investors at Brinc and invited as a speaker on the startup at IndGenius Summit.

**PhenoGAN** Mumbai, India and Atlanta, Georgia
*Founder and Research Lead* *April 2022 - Present*

- **A GAN for Plant Growth estimation and Phenotyping (phenogan.github.io)**: Initially started as a Research project for ISEF'22, won 3rd Grand Award at ISEF and further proceeded to develop into a commercial application. PhenoGAN is a Plant Growth Estimation Framework to help growers in Urban settings like Vertical Farms and Greenhouses improve environmental control by predicting set of environmental conditions required for optimum growth of plants. Currently, this Research is in talks to be taken to labs and industrial settings.

**Global Society of Young Physicists** Remote
*Chief Scientific Associate* *May 2022 - Present*

- **Developing a mentorship program for collaboration of aspiring physicists**: The Global Society of Young Physicists is a non-profit organization registered in the United Kingdom with worldwide operations. It is an affiliate of the United Nations Major Group for Children and Youth. To promote scientific curiosity, we developed a Research Mentorship Program for high school students to work with a mentor and remotely collaborate on conducting a research project related to a field within the physical sciences

## Conferences and Publications

- **Paper Accepted to SmartFarm IEEE Bigdata 2021)**: S21201 "Plant Growth and LAI Estimation using quantized Embedded Regression models for high throughput phenotyping" paper accepted to the conference.
- **Panelist - TinyML Asia Conference 2021 (Video Poster)**: Paper "Plant Growth and LAI Estimation using quantized Embedded Regression models for high throughput phenotyping" accepted as a video poster
- **Paper accepted to 19th ACM Conference on Embedded Networked Sensor Systems (SenSys 2021) (Core A* Ranking)**: Paper "ElastiCL: Elastic Quantization for Communication Efficient Collaborative Learning in IoT" accepted to Sensys
- **Lightning talk at North American Plant Phenotyping Network (NAPPN 2022) conference:**: Paper "Spatio-temporal generation of morphological Plant features for yield prediction before harvest from Visual Image input using Progressively Growing GANs" accepted to the conference as a poster
- **Poster Presentation at International Conference on Precision Agriculture (ICPA 2022)**: Paper "Spatio-temporal generation of morphological Plant features for yield prediction before harvest from Visual Image input using Progressively Growing GANs"
- **ACM/IEEE International Conference on Information Processing in Sensor Networks (IPSN -2022), Core A* Rank Conference**: Paper on "Embedded ML Pipeline for Precision Agriculture" accepted as a poster
- **Program Committee member at CAIML 2022**: Suggestions on event coordination and reviewer for the research received

- **Promoted to a professional member at ACM for contributions to conferences.**:

## Honors and Awards

- Grand Finalist at IRIS (Initiative for Research and Innovation in STEM). Among the top 20 from the country to represent India at ISEF.
- 3rd Grand Award in the category of Plant Sciences at ISEF'22
- Gold Medal winner in the National Category at INSEF (Indian National Science and Engineering Fair - Science Society of India (SSI)). One of the 4 Gold Medalists in the country to represent India at International Genius Olympiad.
- RISE Global Finalist - Schmidt Ventures
- Grand Prize awarded by David EagleMan (PhD in Neuroscience) in Neosensory Competition. Awarded a project grant ($1000) and hardware ($500) for the Research on HapticCV.
- 3rd Place in Arm Devsummit Competition Globally: Awarded $1000 for the research and $300 hardware to scale the project further.
- Hackster UN Impact Prize in Eyes on Edge TinyML challenge: Awarded $250 for the Research and to meet sustainable development goals through the research.
- Best Embedded ML model ($500) in ElephantEdge Challenge and featured in Microsoft Project 15 as well as Hackster. Received further collaboration with Smart Parks and Irnas Institute for deploying the algorithms on Elephant Collars.
- 2nd place Touch Less Do More Arduino Hackathon: Received $3250 for the project "Spectrino", an IoT and Embedded system suite to establish touch free human-machine interactions.
- BuildWithAI: Runner Ups in Data Visualization Category - Developed person density monitoring system in supermarkets to help curb covid spread. Received $500.
- ISEF Mini Hackathon XDHacks Mini 2nd Place: Developed a filter utilizing Cyanobacteria as Carbon Fixators as a team of five which took place as an in-person event at ISEF'22

## Courses

- New York Math Summer Program - Black level
- 6.801 Machine Vision - MIT OpenCourseWare
- 6.0001 Introduction to Computer Science and Programming in Python - MIT OpenCourseWare
- TinyML2 - Applications of TinyML - MIT edX - HarvardX
- 18.02.1x Multivariable Calculus 1: Vectors and Derivatives - MIT edX

## Volunteering

- **Volunteered at Microsoft Project 15. Remote, Implemented - Liwonde National Parks, Malawi, South Africa**: Worked with Irnas Institute and Smart Parks to deploy Elephant Tracking technology on African Elephants under guidance by Tim Van Dam
- **Student Volunteer at Adolescent Health Champions**: 501(c)(3) Non-Profit and peer-to-peer education program globally training young people to teach peers about health

Schemobotics

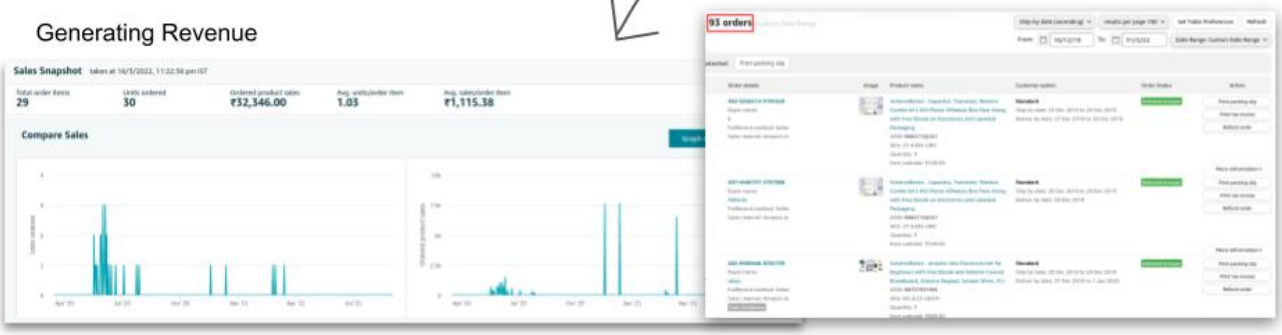
SchemBotics.com progress


Insourcing Electronic components from local suppliers



Creating custom product kits after Market Survey and calculating pricing. Listing multiple products -> designing website using Wordpress over 6 months

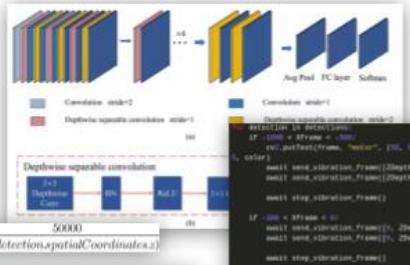
Generating Revenue

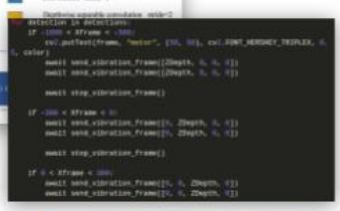



Team HapticCV

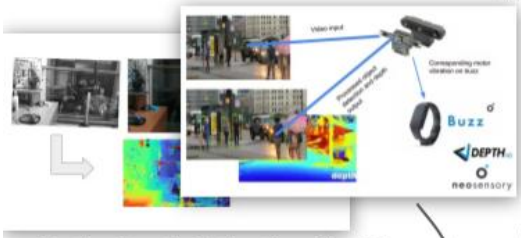
Revolutionizing bicycle commute, an algorithm at a time

HapticCV - SpatialAI based Computer Vision for revolutionizing Bicycle Commute with Haptic Stimulus



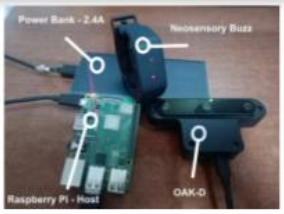



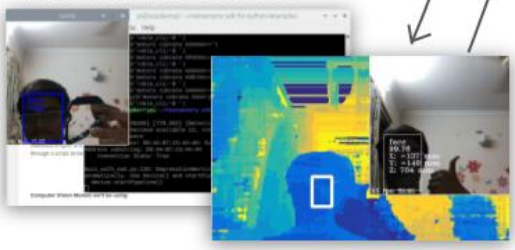
$$Motor_{intensity} = 100 + \frac{50000}{int(detection.spatialCoordinates.z)}$$




Testing Depth Estimation Algorithms best-suited for the project

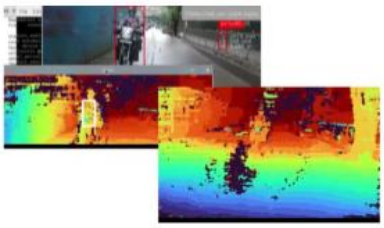
Designed Algorithm, ML model and Code for the project




Hardware Setup for the Project, practical deployment and testing on Road

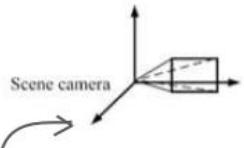
Unit-testing part of the algorithms developed and concatenating approaches piece-wise



Schepens Eye Research Institute
Massachusetts Eye and Ear

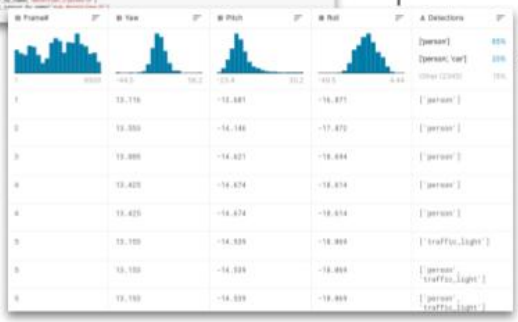
Harvard Medical School Affiliate

Student Research Intern under Prof. Ayush Kumar



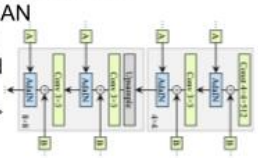

Extracting eye-gaze information and carrying out object detection for semantic understanding of classes and studying behavior of hemineglect population

Python code to generate results



Generated results logged as CSV for data visualization and behaviour understanding on heminglects in Gang Luo's Lab.

StyleGAN model utilized

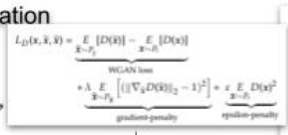


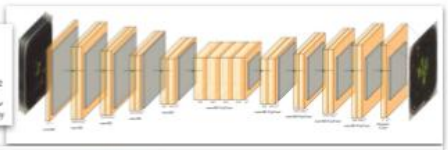

Generating fake eye images from synthetic eye gaze dataset to expand SERI, Harvard eye image dataset using GANs (a First approach)

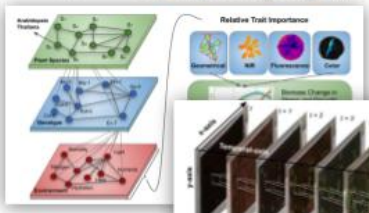
A Machine Learning approach for Plant Growth Estimation

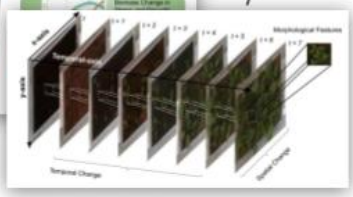
PhenoGAN

https://phenogan.github.io/



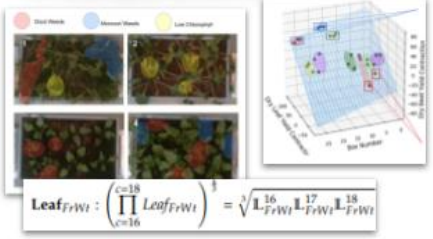






Training the model over different parameters

Analyzing the problem and complexity of creating predictive models

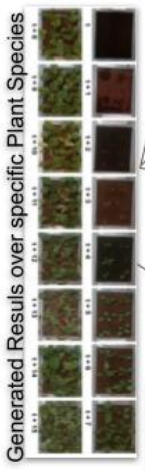


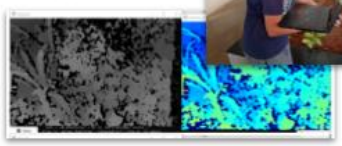


$$\mathbf{Leaf}_{FrWt} : \left(\prod_{c=16}^{c=18} Leaf_{FrWt}\right)^{\frac{1}{3}} = \sqrt[3]{\mathbb{1}^{16}_{FrWt}\mathbb{1}^{17}_{FrWt}\mathbb{1}^{18}_{FrWt}}$$

Analysis of data and visualization

Generated Resuls over specific Plant Species





Testing model over different plants

Colab Notebook to train your Spatio-Temporal PhenoGAN model on custom data. Documentation coming soon.


Collaborating with Vertical Farms and Research Labs for providing free access to the software