Abhishek V. Potnis

Contact Information

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Google Scholar | ORCID | Github

Research Interests

Knowledge Representation and Reasoning, Geospatial Semantics,
Deep Learning for Computer Vision, Satellite Image Processing,
Geographic Information Systems, Natural Language Processing, Internet Of Things

My doctoral research lies in the areas of Deep Learning and Geospatial Semantics, towards leveraging Knowlede Graphs for enhanced Scene Understanding of Remote Sensing Scenes

Education

Indian Institute of Technology Bombay
M.Tech. - PhD. Dual Degree — July 2014 - 2021(Expected)
Specialization: Geoinformatics
CPI: 9.28

University of Mumbai
Bachelors of Engineering (B.E) — July 2009 - July 2013
Specialization: Computer Engineering
Percentage: 74.26

Peer Reviewed Publications

- **Semantics-Driven Remote Sensing Scene Understanding Framework for Grounded Spatio-Contextual Scene Descriptions**
  Abhishek Potnis, Surya Durbha, Rajat Shinde
  ISPRS International Journal of Geo-Information, 2021
- **Towards Visual Exploration of Semantically Enriched Remote Sensing Scene Knowledge Graphs(RSS-KGs)**
  Abhishek Potnis, Rajat Shinde, Surya Durbha
  IEEE International Geoscience and Remote Sensing Symposium 2021 (IGARSS 2021) [Accepted]
- **Towards Enabling Deep Learning based Question Answering for 3D LiDAR Point Clouds**
  Rajat Shinde, Surya Durbha, Abhishek Potnis, Pratyush Talreja, Gaganpreet Singh
  IEEE International Geoscience and Remote Sensing Symposium 2021 (IGARSS 2021) [Accepted]
- **Real-time Embedded HPC based Earthquake Damage Mapping using 3D LiDAR Point Clouds**
  Pratyush Talreja, Surya Durbha, Rajat Shinde, Abhishek Potnis
  IEEE International Geoscience and Remote Sensing Symposium 2021 (IGARSS 2021) [Accepted]
- **Towards Natural Language Question Answering Over Earth Observation Linked Data Using Attention-Based Neural Machine Translation**
  Abhishek Potnis, Rajat Shinde, Surya Durbha
  IEEE International Geoscience and Remote Sensing Symposium 2020 (IGARSS 2020), United States of America
- **Online Point Cloud Super Resolution Using Dictionary Learning For 3D Urban Perception**
  Rajat Shinde, Abhishek Potnis, Surya Durbha

IEEE International Geoscience and Remote Sensing Symposium 2020 (IGARSS 2020), United States of America

- **Multi-Class Segmentation of Urban Floods from Multispectral Imagery using Deep Learning.**
  Abhishek Potnis, Rajat Shinde, Surya Durbha, Kuldeep Kurte
  IEEE International Geoscience and Remote Sensing Symposium 2019 (IGARSS 2019), Japan
- **Semantics enabled Spatio-Temporal Modeling of Earth Observation Data: An application to Flood Monitoring.**
  Kuldeep Kurte, Abhishek Potnis, Surya Durbha
  ACM SIGSPATIAL 2019 International Workshop on Advances in Resilient and Intelligent Cities 2019 (ARIC 2019), United States of America
- **A Semantic Framework for Spatial Query Reformulation for Disaster Monitoring Applications.**
  Kuldeep Kurte, Abhishek Potnis, Rajat Shinde, Surya Durbha
  IEEE International Geoscience and Remote Sensing Symposium 2019 (IGARSS 2019), Japan
- **Compressive Sensing based Reconstruction and Classification of VHR Disaster Satellite Imagery Using Deep Learning.**
  Rajat Shinde, Abhishek Potnis, Surya Durbha, Prakash Andugula
  IEEE International Geoscience and Remote Sensing Symposium 2019 (IGARSS 2019), Japan
- **Rapid Earthquake Damage Detection using Deep Learning from VHR Remote Sensing Images.**
  Ujwala Bhangale, Surya Durbha, Abhishek Potnis, Rajat Shinde
  IEEE International Geoscience and Remote Sensing Symposium 2019 (IGARSS 2019), Japan
- **A Geospatial Ontological Model for Remote Sensing Scene Semantic Knowledge Mining for the Flood Disaster.**
  Abhishek Potnis, Surya Durbha
  IEEE International Geoscience and Remote Sensing Symposium 2018 (IGARSS 2018), Spain
- **On-Board Biophysical Parameters Estimation using High Performance Computing.**
  Pratyush Talreja, Surya Durbha, Abhishek Potnis
  IEEE International Geoscience and Remote Sensing Symposium 2018 (IGARSS 2018), Spain
- **A Spatio-Temporal Ontological Model for Flood Disaster Monitoring.**
  Kuldeep Kurte, Surya Durbha, Roger King, Nicolas Younan, Abhishek Potnis
  IEEE International Geoscience and Remote Sensing Symposium 2017 (IGARSS 2017), United States of America
- **Exploring Visualization of Geospatial Ontologies Using Cesium**
  Abhishek Potnis, Surya Durbha
  International Workshop on Visualization and Interaction for Ontologies and Linked Data(VOILA 2016), International Semantic Web Conference 2016 (ISWC 2016), Japan

Thesis

Doctoral Thesis: Semantics-driven Scene Understanding and Multi-modal Rendering from Remote Sensing Scenes
Supervisor: Prof. Surya Durbha

- Leveraging **Deep Learning based Semantic Segmentation** in tandem with a Knowledge based approach for Formalization, Extraction and Mining of Contextual Spatial Semantics
- Modelling Remote Sensing Scenes in the form of **Knowledge Graphs** through the

development of Ontologies

- Multi-modal rendering of Remote Sensing Scene Knowledge Graphs(RSS-KGs) in the form of **Grounded Contextual Natural Language Scene Descriptions** and **Visualizations** to enhance the interpretability and understanding of Remote Sensing Scenes, focusing on disaster scenarios

Bachelor's Thesis: An Open Web App for Edting and Storing Rich Text Documents Jun. 2012 - Jun. 2013

Mozilla Student Project

Supervisors: Dr. David Rajchenbach-Teller, Mozilla and Prof. Sangita Chaudhari

- Worked in a group of 3 to develop a ubiquitous web application to edit rich text documents
- The web app made use of IndexedDB API of HTML5 to store and retrieve user documents
- The web app supported adding pictures from gallery and also printing of documents

Professional Experience

Google Summer of Earth Engine 2019 - Research Programme
Identifying Cropping Patterns using Machine Learning for Tracing Wildlife Conflict in India Jun. 2019 - Aug. 2019

Organization: Centre for Wildlife Studies | Mentor: Anubhav Vanamamalai

- Implemented Supervised Satellite Image Classification for identifying different crop types using Google Earth Engine for understanding wildlife conflict
- Experimented with different classification approaches such as Random Forest, SVM and ANN, to maximize model performance

Google Summer of Code 2016 May 2016 - Aug. 2016
Enabling Cesium for Liquid Galaxy, *Organization: Liquid Galaxy*

Mentor: Andrew Leahy, Western Sydney University

- Developed a web application, enabling Cesium - a WebGL based virtual globe to run across the multiple displays, providing an immersible experience to the users
- Focused on endowing Cesium with features such as Camera Synchronization, Content Synchronization across the displays and Space Navigation Camera Control.

Google Summer of Code 2015 May 2015 - Aug. 2015
NASA's Data Curtains from Space, *Organization: Cesium Community*

Mentors: Ryan Boller, Mike McGann, NASA

- Developed a web application to process and visualize LiDAR Profiles captured by the CALIPSO Satellite with the orbital tracks of the satellite and Aqua-MODIS-Reflectance as the base layer, using CesiumJS

Cybertech Systems and Software Ltd. Dec. 2014

Role: Winter Intern - GIS Web Developer

- Developed Keyhole Markup Language(KML) File Reader Widget for ESRI's Web App Builder using ESRI's ArcGIS JS API
- Developed a proof of concept prototype location based web application with offline usability for Hydrant Maintenance Personnel to record maintenance related events

Open Source Contributions

Mozilla Firefox 2012 - 2016

Code and Documentation Contributions

- Fixed front-end and performance related bugs by authoring code patches in JavaScript and C++ for Mozilla Firefox
- Edited and improved technical articles on Mozilla Developer Network
- Recognized as a core contributor in the "about:credits" section of Mozilla Firefox

Other Projects

Identifying Solar Farms in India using Machine Learning with Google Earth Engine Mar. 2019

Google Earth Engine India Advanced Summit Buildathon 2019

- Worked in a team to employ the Random Forest Classifier with R,G,B, NIR and VV Polarization as features to obtain an Accuracy of 81.07%
- Added Wavelet Kernel-based Convolution as an additional feature to detect solar panels' texture thus improving the Accuracy to 83.65%

SenseQube - An Internet of Things(IoT) based platform for Smart Agriculture 2017 - 2020

Research Project funded by the Ministry of Electronics and Information Technology, Government of India

- Worked in a team, to develop an IoT based end-to-end platform consisting of an integrated weather station to advice farmers in implementing precision agriculture practices
- Worked with sensors and embedded systems for data dissemination along with server side scripting, databases and machine learning models to generate actionable insights such as crop water requirement and disease susceptibility for farmers to improve crop yield
- Presented at the DST-JST Indo-Japan Project Meeting under the Strategic International Collaborative Research Program (SICORP) at IIT Hyderabad

Pratham - IIT Bombay Student Satellite Oct. 2014 - Sep. 2016

IIT Bombay's largest student technical initiative in collaboration with ISRO
Role: Electrical Sub-System Team Member and Web Manager

- Implemented the AX.25 protocol in embedded C for communication between the Ground-Station and the Satellite
- Developed the Satellite Telemetry Monitoring application in Matlab, for accessing the performance of the Thermo-Vacuum test in real-time

An Integrated Client-Server based Interoperable Geographic Information System for Forest Fire Monitoring Aug. 2015 - Oct. 2015

Geospatial Data Interoperability and Standards Course Project

- Worked in a team to develop an AJAX driven interactive web client aimed at integrating and querying geospatial data conforming to Open Geospatial Consortium(OGC) specifications
- Integrated services such as Web Feature Service(WFS), Web Map Service(WMS), Web Coverage Service(WCS) and Sensor Observation Service(SOS) to form a web mash-up

Satellite Image Classifier using Parallelepiped Classification

Satellite Image Processing Course Project Aug. 2014 - Oct. 2014

- Studied and implemented the pixel based Parallelepiped Classifier for classifying satellite imagery into land use land cover classes
- Developed an interactive web application for training the classifier to generate a model and perform satellite image classification

Emergency Response Route Navigation and Simulation of Bus Service in IIT Bombay Campus Aug. 2014 - Oct. 2014

Geographic Information Systems Course Project

- Implemented a web app for route navigation, to identify the nearest bus from an emergency location and guide it using the shortest possible route computed using Dijkstra's algorithm

Teaching Experience

Teaching Assistant, GNR 629: Advances in Geospatial Standards, Interoperability and Knowledge Discovery
Teaching Assistant, GNR 605: Principles of Geographic Information Systems
Teaching Assistant, GNR 636: Remote Sensing of Vegetation
Teaching Assistant, GNR 615: Geographic Information Systems Lab
Teaching Assistant, GNR 402: Introduction to Geographic Information Systems

Relevant Skills

Languages, Frameworks , Databases, Tools and Version Control Systems
Java, C++, Python, HTML5, CSS3, JavaScript, PHP, JSP, AJAX, XML;
Keras, TensorFlow, PyTorch;
Android SDK, NodeJS, jQuery, Twitter Bootstrap, ArcGIS JS API;
Oracle, MySQL, PostGreSQL, PostGIS, SPARQL, GeoSPARQL;
ArcGIS, QGIS, Erdas Imagine;
Git, Mercurial

Certifications

Deep Learning Specialization Apr. 2019
Instructor: Dr. Andrew Ng, Coursera
Oracle Certified Professional Java Programmer SE - 6 Jul. 2012
Secured 96% in the OCJP SE-6 Certification Examination

Community Memberships

- IEEE Student Member
- IEEE Geoscience and Remote Sensing Society (GRSS) Student Member
- Student Member of Resources Engineers Association (REA), CSRE, IIT Bombay

Synergistic Activities

Manuscript Reviewer
- IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (IEEE JSTARS)
- Earth Science Informatics, Springer
- Journal of the Indian Society of Remote Sensing, Springer

Session Manager
- IEEE International India Geoscience and Remote Sensing Symposium 2020
- IEEE International Geoscience and Remote Sensing Symposium 2020

Awards and Achievements

- Recipient of the Google Cloud Platform Academic Research Credits Grant
- Successfully completed the Google Summer of Earth Engine project "Machine Learning based Mapping of Croplands with Google Earth Engine for Identifying Human-Wildlife Conflict Locations" with Centre for Wildlife Studies
- Winner of Google Earth Engine India Advanced Summit Buildathon 2019 for the project - "Identifying Solar Farms in India using Machine Learning with Google Earth Engine"
- Successfully completed an 8-week Entrepreneurship Bootcamp (July-September 2019) organized by TiE Delhi-NCR for ITRA, Digital India Corporation, New Delhi
- Quarter-Finalist for the India Innovation Challenge 2017 hosted by IIM Bangalore and conducted by Government of India and Texas Instruments
- Recipient of the IEEE Geoscience and Remote Sensing Society Travel Grant to present at IEEE Geoscience and Remote Sensing Symposium (IGARSS) 2018, Spain
- Recipient of the International Semantic Web Conference 2016 Student Travel Grant funded by Semantic Web Science Association (SWSA) and the US National Science Foundation (NSF) to present at ISWC 2016 in Kobe, Japan
- Recipient of the Ministry of Human Resources Development(MHRD), Govt. of India Fellowship

- Successfully completed Google Summer of Code 2016 project "Enabling Cesium with Liquid Galaxy" with Liquid Galaxy
- Winner of the Esri India's mApp Your Way 2015 App Development Challenge for the application - 'Route Navigation and Pothole Monitoring using Crowd Sourced Pothole Mapping' in Dec. 2015
- Successfully completed Google Summer of Code 2015 project "NASA's Data Curtains from Space" with Cesium
- Represented IIT Bombay for the SAP InnoJAM Challenge 2016 held at SAP Labs, Bangalore
- Name listed as a Core Code Contributor on the Mozilla Monument outside Mozilla's Office in San Francisco, CA, USA
- Successfully completed Module 1 of French Language Course conducted by International Relations Office, IIT Bombay, in association with Embassy of France, New Delhi in Dec. 2014

Selected Talks

- **"Machine Learning based Multi-Class Segmentation of Urban Flood Remote Sensing Scenes with Google Earth Engine"**
  Lightning Talk, Google's Geo For Good Summit 2020 — October 2020
- **"Deep Learning for Computer Vision and Natural Language Processing"**
  Invited Talk, Vidyavardhini's College of Engg. and Tech., Mumbai — June 2020
- **"Machine Learning based Crop Mapping using Google Earth Engine"**
  Partner Panel Talk, Google's Geo for Good Summit 2019, USA — September 2019
- **"TensorFlow and Google Earth Engine"**
  Invited Talk, Google Earth Engine Student Summit, IIT Bombay — September 2019
- **"Flood Mapping with Google Earth Engine"**
  Invited Talk, Google Earth Engine India Community — July 2019
- **"Role of Deep Learning in Disaster Monitoring"**
  Invited Talk, Intel AI Meetup, Mumbai — September 2018
- **"QGIS Workshop "** - Two-day Workshop with Dr. Kuldeep Kurte
  Invited Workshop, GeoWeek 2017, Fergusan College, Pune — October 2017
- **"History of Open Source and Contributing to Mozilla"**
  Thadomal Shahani College of Engineering(TSEC), Mumbai — October 2014
- **"Contributing to Open Source"**
  MozTalk, Web and Coding Club, IIT Bombay — June 2013
- **"Preparing for Google Summer of Code"**
  Talks conducted annually at CSRE, IIT Bombay in January of 2017 - 2021

Positions of Responsibility

- Organizing Team Member, Google Earth Engine Student Summit, IIT Bombay 2019
- Organizing Team Member, Asia-Pacific Federation for Information Technology in Agriculture(AFITA) 2018 Conference, IIT Bombay 2018
- Organizing Team Member, De-HPC Conference, IIT Bombay 2016
- Electrical Sub-System Team Member and Web Manager, IITB Student Satellite Initiative 2014-2016
- Web Coordinator, Hostel 12, IIT Bombay 2017
- Institute Student Mentorship Program Web Nominee, IIT Bombay 2016
- Department Web Nominee, CSRE, IIT Bombay 2016
- Technical Head, Computer Society of India - VCET Student Chapter 2013