Anuj Pahuja

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Research Interests

Computer Vision, Computational Photography, Graphics, Deep Learning

Education

2011 - 2015 **Birla Institute of Technology and Science, Pilani**
B.E.(Hons.) in Computer Science

Research Experience

Oct 2017 - Current **Project Assistant, Indian Institute of Science** | Bangalore
Advisor: Prof. Venkatesh Babu
I am working at the **Visual Analytics Lab** on deep learning approaches for the following problems -
Monocular Depth Estimation: Robust and novel methods for estimating depth from single image. Our recent work is under review for CVPR 2018, where we present state-of-the-art results.
Object dynamics transfer: Data-driven approaches to simulate and transfer object dynamics from visual media to a target image.
Portrait segmentation and Blending: Real-time pipeline for portrait segmentation and blending from selfies.

Mar 2015 - Jun 2015 **Undergraduate Researcher, UC Santa Cruz** | Remote [Code] [Results] [Poster]
Advisor: Prof. James Davis
I participated in the Aspiring Researcher's Challenge, which was jointly organized by faculty from UCSC, Stanford and Cornell. Our results were published as a WIP poster at AAAI HCOMP.
Cost-Effect analysis of CPU vs HPU: Worked on automated object localization and the cost-effect relationship of employing HPU (Human Processing Unit) in identifying objects in an image.
HPU Interface: Created a web interface for HPU-based object localization on the UIUC Car Dataset.

Jan 2015 - May 2015 **Undergraduate Researcher, BITS Pilani** | Pilani, Rajasthan [Code]
Advisor: Prof. Sundar Balasubramaniam and Prof. Geetha B.
I worked on an interdisciplinary digital humanities project aimed at creating a digital archive for regional paintings.
Image Retrieval System: Implemented a Content based Image Retrieval system from scratch using local texture similarity and a global SIFT-based bag-of-features model.
Web Interface: Developed a server platform for efficiently uploading and indexing images based on their syntactic annotations, and a client platform for customized image queries.

Professional Experience

Jul 2015 - Oct 2017 **Member of Technical Staff - Computer Vision, Tonbo Imaging** | Bangalore [Demos]
Computer Vision startup that builds advanced night-vision systems for military reconnaissance.
Multi-Sensor System for Situational Awareness (Project Lead): Built a 360 degree multi-sensor panoramic system for surveillance that fuses Mid-Wave IR with visible spectrum images, stitches them and streams out in real-time to multiple devices. Designed the architecture, software pipeline and communication for this system.
Advanced Driver Assistance Systems (Project Lead): Built an end-to-end automotive HUD proof-of-concept prototype for enhanced driver vision and obstacle detection during adverse environmental conditions. The system tracks driver's eye position and synthesizes a corrected view in real-time. Tested the system successfully on a windshield as well as AR HMDs.
Mixed Reality Applications: Developed a video streaming and visualization platform for Microsoft Hololens. The platform allows integration of Hololens with different camera systems, allowing bi-directional master/slave communication.
Video Panoramas and Object Tracking: Developed efficient image stitching and object tracking algorithms for embedded platforms that are successfully deployed on multiple imaging devices for ATVs and UAVs.

May 2015 - Aug 2015 **Student Developer, Google Summer of Code** | Remote [Project] [Results]
Organization: The Eclipse Foundation
Implemented cloud-removal algorithms for satellite imagery as an added functionality for *GeoTrellis* - a pure Scala based raster processing framework.

Jul 2014 - Dec 2014 **R&D Intern, Tonbo Imaging** | Bangalore [Demo]
Camera Simulator: Created a customizable OpenSceneGraph application to simulate cameras and camera motion on ships while also rendering the corresponding ocean environment.
IMU based rolling shutter correction: Developed and implemented algorithms for online and offline video stabilization and rolling shutter rectification for CMOS sensors using inertial measurement units.
Multi-object tracking: Implemented efficient tracking algorithms to track multiple objects in real-time for camera systems mounted on UAVs and ATVs.

May 2014 - Aug 2014 **Student Developer, Google Summer of Code** | Remote [Project]
Organization: KDE
Ported KDE Games module to the new KDE Frameworks 5 and Qt5 libraries, which involved porting the common game libraries and three standalone games - KBounce, KNavalBattle and KMines.

Dec 2013 - Jan 2014 **Intern**, Forus Health, Bangalore
A medical imaging startup that builds and supplies fundus cameras, retinal scanners and other opthalmology equipments.
Performed simulations and implemented automated image manipulation procedures while working on a broader framework for a lensometry algorithm.

May 2013 - Jul 2013 **Intern**, Bhaskaracharya Institute for Space Applications and Geo-Informatics, Gandhinagar
A state level nodal agency that facilitates the use of spatial and geo-spatial technologies for remote sensing.
Created a JAVA based GUI app to perform various lossless compression algorithms (including LZW, ZLib and Deflate) on multi-spectral medical images and compare their efficiency.

Teaching

Jan 2015 - May 2015 **Teaching Assistant, Computer Programming** | BITS Pilani
Course Instructor: Dr. Vishal Gupta
Helped in creating exercises, organizing the course content and online evaluation over edX platform.

Other Projects

- **AR/VR Dining Experience**
  Developed a mixed reality application to segment and track the fork along with the food using Intel Realsense and Unity. The food could in turn be replaced by any food item, with a custom background and experienced in real-time on a VR headset.
- **AR Vein Imager**
  Developed a prototype of an augmented reality based portable skin surface viewer that allows for easy sight of veins enabling quick and accurate injections. This was done as a part of MIT ReDx camp.
- **Obstacle Detection System**
  Created a stereo-based depth estimator using commodity webcams in conjunction with a semantic text-to-speech converter as part of an obstacle detection system for blind.

Technical Skills

Languages: C, C++, Python, Java, JavaScript, Scala, Bash, LaTeX
Tools/Software: Git, Qt, Visual Studio, MATLAB, Unity, Cmake, Android Studio
APIs: OpenCV, CUDA, TensorFlow, PyTorch, Keras, Gstreamer, FFmpeg
Platforms: Nvidia TX1/TX2, Microsoft Hololens, ODG R7, Intel RealSense, Leap Motion, Tobii EyeX, Arduino

Scholastic Achievements

KVPY Shortlisted for KVPY Scholarship awarded by Dept. of Science and Technology, Government of India, *2011*.
IIT-JEE All India Rank 4323 in Joint Entrance Examination (among 500,000), *2011*.
AIEEE All India Rank 2949 in All India Engineering Entrance Examination(among 1,100,000), *2011*.
BITSAT All India Rank 72 in BITSAT(among 120,000), *2011*.

Selected Coursework:

Image Processing, Pattern Recognition, Computer Graphics, Machine Learning, Computer Vision

Other Activities

- **Mentor** Google Code-In, *2016, 2014*.
- **Mentor** Learn IT, Girl, *2016*.
- **Mentor** Season of KDE, *2014-15*.
- **Student Representative** Google Summer of Code Reunion in San Jose, California, *2014*.
- **Group Leader** Department of Stage Controls, BITS Pilani, *2011-2015*.
- **Group Leader** ARBITS, BITS Pilani, *2011-2015*.