Dr. Punarjay (Jay) Chakravarty

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Website: http://www.jaychakravarty.com. Born: May 23, 1981. Residency: Australian citizen.

Objective

To pursue academic and industry-based research and development in computer vision, machine learning and artificial intelligence and their applications in smart devices.

Work Experience

KU Leuven, Belgium Oct 2013 - present

I am a post-doc at KU Leuven, Belgium, where I'm part of the Cametron project. The project is about using computer vision and robotics technology for autonomous film-making, both from pan-tilt cameras and from cameras on quadrotor helicopters.

SenSen Networks, Australia 2007-Oct 2013

I formed part of a small team in a start-up company (www.sensennetworks.com). I researched, developed, tested & installed commercial-grade systems for surveillance, enforcement and business intelligence using video. I was involved in the following projects:

- **SenForce (mobile)**: I was the tech lead and owner of this project. The system reads car license plates from a mobile parking enforcement vehicle. Parking overstays are detected (based on parking rules and zones uploaded into a database) and the position of infringing vehicles is triangulated using the enforcing vehicle's GPS and vision-based triangulation, based on algorithms that I developed. I successfully marketed and delivered 6 vehicles fitted with the system to 4 councils in Brisbane, Perth and Sydney in Australia. In addition to being the tech lead, I was the main point of contact for this product with clients and had to manage customer relations and expectations as well.

  More details in this video: http://www.youtube.com/watch?v=j9Y_933ZP4g

- **SenPort**: I helped develop and set up software for a system of 80 servers doing video analytics (face recognition, left luggage detection, loitering detection, etc.) for 400 cameras at the Abu Dhabi International Airport. The setup was the first of its kind, had tight deadlines and involved many hardware and software challenges. I managed tense relations between my team and the system integrator company to successfully deliver what is the largest deployment of video analytics in the world.

- **SenCount**: The system tracks and counts people in crowds from pre-existing, non-top-down camera views. It produces long-term graphs and heat maps of peoples' movements. I was part of a team that developed the software and have personally setup the system at sites including universities, shopping centres and intersections around Australia.

- **SenForce (fixed)**: The system detects and reads car license plates from fixed cameras on highway gantries. It detects unregistered vehicles and point-to-point speeding. I was part of a team that developed the software and setup the system at 16 sites across New South Wales, Australia. Again, temperatures exceeded 45-degree Centigrade at the sites and I, along with my team, worked

beyond expected working hours to get the project delivered successfully and on time.

- **Gas Station Drive-off detection**: I helped develop and deploy a network of cameras and servers with software in gas (petrol) stations around Melbourne that alerts operators to the entry of vehicles that have driven off without paying for petrol at a previous time. In addition to helping petrol station owners save hundreds of dollars in drive-offs every week, it has also been used by the police to track down criminals. The price-point of this system is low, and consequently, number plate recognition is done with cheaper cameras than are used for the other systems. This led to challenges that certain plates (eg: slim-line plates) were not being read correctly. I was responsible for the on-site debugging and rectification of these problems and delivered the system to the customers' satisfaction.

- **Pedestrian/Bikes stats collection**: I helped develop algorithms and software for a system that detects, classifies and determines the speed of people, cyclists and mobility scooters along pedestrian and cycle lanes and walkways. The system is being used by the cities of Brisbane and Melbourne to collect statistics on the use of these walkways.

National ICT Australia (NICTA)/SenSen Joint Venture 2010-2012

Worked on

- Algorithms for detecting and tracking cells in microscopic imagery.

- Gesture recognition using accelerometers and gyroscopes for Parkinson's patients.

Centre for Artificial Intelligence and Robotics (CAIR), India 2005

- Developed a system for the localization of a motorized wheelchair in the facility using only a forward-looking camera.

Education

Monash University, PhD in Robotics 2005-2010

Surveillance and Intervention: Collaboration Between a Robot and Fixed Cameras

Supervisor: Prof. Ray Jarvis

Developed a networked, surveillance system with the following features:

- Simultaneous localization of a mobile robot on the ground plane and in the image plane of external cameras, leading to the build-up of homography between the cameras and the ground plane.

- Robot movement used to autonomously calibrate fixed cameras to the ground plane.

- Fixed cameras track people on the ground plane.

- Robot tracks people around it using a panoramic camera and laser range finders while it is navigating through its environment.

- System able to navigate the robot to an intruder seen through overhead cameras but out of range of robot's sensors. Once within range, robot's on-board sensing takes over.
- System also able to recognize possible covert behavior of people by analyzing their ground plane trajectories.

University of Melbourne, Bachelor of Engineering with Honours in Electrical Engineering 2000-2004

Skills

Algorithms

Implementation of algorithms using knowledge in the following areas:

- Image processing
- Multiple view geometry (stereo vision, 3D structure from motion)
- Multiple target tracking and data association
- Machine learning (statistical modeling & probabilistic reasoning)

Programming/Operating Systems/APIs

- Matlab (proficient)
- C/C++ (proficient)
- Parallel programming using CUDA (some)
- Java (some)
- Python (some)
- Linux, OS X and Windows environments (proficient)
- OpenCV Library for Computer Vision (proficient)
- Google API for mobile app development (some)
- Robot Operating System or ROS (some)

R&D Hobby Projects

- Android phone based mobile robot (http://www.jaychakravarty.com/?cat=16)
- 3D design and printing for rapid prototyping (http://www.jaychakravarty.com/?cat=19)
- Low power car surveillance system (http://www.jaychakravarty.com/?p=208)

Self-Education & Professional Development

Online Courses

- Artificial Intelligence (conducted by Sebastian Thrun and Peter Norvig from Stanford University) 2011
- Machine Learning (conducted by Andrew Ng from Stanford University) 2011
- Autonomous Driving (conducted by Sebastian Thrun on Udacity) 2012
- Introduction to Parallel Programming (conducted by John Owens, University of California, Davis on Udacity) 2013
- C++ for C Programmers (Coursera) 2013
- Probabilistic Graphical Models (Coursera) 2013

Publications

- D. Rawlinson, P. Chakravarty and R. Jarvis. "Distributed Visual Servoing of a Mobile Robot for Surveillance Applications". In 2004 Australasian Conference on Robotics and Automation (ACRA'04), Canberra, Australia, Dec. 2004.
- P. Chakravarty and R. Jarvis. "Multiple Target Tracking for Surveillance: A Particle Filter Approach". In IEEE International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP'05), Melbourne, Australia, Dec. 2005.
- P. Chakravarty and R. Jarvis. "Panoramic Vision and Laser Range Finder Fusion for Multiple Person Tracking". In IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'06), Beijing, China, Sep. 2006.
- P. Chakravarty, D. Rawlinson and R. Jarvis. "Person Tracking, Pursuit & Interception by Mobile Robot". In 2006 Australasian Conference on Robotics and Automation (ACRA'06), Auckland, New Zealand, Dec. 2006.
- P. Chakravarty, A. M. Zhang, R. Jarvis, and L. Kleeman. "Anomaly detection and tracking for a patrolling robot". In 2007 Australasian Conference on Robotics and Automation (ACRA'07), Brisbane, Australia, Dec. 2007.
- P. Chakravarty and R. Jarvis. "People Tracking from a Moving Panoramic Camera". In 2008 Australasian Conference on Robotics and Automation (ACRA'08), Canberra, Australia, Dec. 2008.
- P. Chakravarty and R. Jarvis. "External Cameras & A Mobile Robot: A Collaborative Surveillance System". In 2009 Australasian Conference on Robotics and Automation (ACRA'09), Sydney, Australia, Dec. 2009.

- P. Chakravarty, D. Rawlinson and R. Jarvis. "Covert Behaviour Detection in a Collaborative Surveillance System". In 2011 Australasian Conference on Robotics and Automation (ACRA'11), Melbourne, Australia, Dec. 2011.
- N. Ho and P. Chakravarty. "Localization on Freeways using the Horizon Line Signature". Workshop on Visual Place Recognition in Changing Environments at the International Conference on Robotics and Automation (ICRA '14), to appear.