

Curriculum Vitae

Arturo Donate, Ph.D.

Personal Information

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Research Interests: Computer Vision, Image Processing, Pattern Recognition

Academic Degrees

- **Doctor of Philosophy in Computer Science** (GPA: 3.7/4.0)
Florida State University, Tallahassee, FL (2011)
Dissertation: Three-Dimensional Scene Estimation From Monocular Videos with Applications in Video Analysis
- **Masters of Science in Computer Science** (GPA: 3.9/4.0)
Florida Institute of Technology, Melbourne, FL (2006)
Thesis: Image Recovery of Dynamic Scenes
- **Bachelors of Science in Computer Science, minor in Mathematics** (GPA: 3.1/4.0)
University of Miami, Coral Gables, FL (2004)
Senior Project: "Helicopters!": 2D videogame developed using the Win32 API

Professional Experience

Associate, Booz Allen Hamilton February 2012 - Present

- Involved in biometrics and digital forensics research and development.

Research Assistant, Florida State University August 2006 - September 2011

- Developed a multi-threaded framework for real-time 3D feature extraction from monocular videos utilizing SLAM, structure from motion, and GPU acceleration.
- Researched techniques for applying 3D measurements taken from 2D videos in order to solve various video analysis problems including 2D to 3D conversion and human detection/tracking.
- Designed an algorithm for estimating the 3D motion of a person from a monocular videos.
- Developed a stereo-matching algorithm capable of computing correspondences with sub-pixel accuracy via normalized cross correlation, using integral images for efficiency.
- Implemented various kernel functions applied to pairwise geodesic distances for use with 3D surface registration algorithms.
- Instructor of record for CDA 3100, Computer Organization I.
- Responsible for grading as well as teach several recitation classes for COP3330 Object Oriented Programming in C++.
- Implemented a framework for 3D people tracking with stereo cameras from a robotic platform.
- Implemented a framework capable of segmenting and classifying various regions in an aerial photograph using LIDAR data and SVM classifiers.

Intern, Technicolor Research May 2010 - August 2010

- Designed a framework capable of generating stereoscopic views of a scene for automatic 3D video conversion.
- Developed software for estimating the egomotion of a camera from a 2D video.
- Implemented various structure-from-motion algorithms and self-calibration methods.

Research Assistant, Florida Institute of Technology January 2005 - August 2006

- Designed an image segmentation algorithm for underwater images of coral reefs using texture measurements across various color channels along with the EM algorithm.
- Developed and implemented an algorithm to model and remove visible distortions, caused by surface waves, in videos viewing underwater scenes by using K-means clustering and Fourier frequency domain analysis.
- Developed an algorithm to generate a clear view of a scene occluded by moving clouds of smoke by quantifying the amount of occlusion using K-means clustering along with color histograms.
- Designed a texture classification framework for use with textures distorted by water waves.

Professional Qualifications

- Proficient in various programming languages including C, C++, and MATLAB; Some familiarity with various other languages including C# and Java
- Experienced using several libraries including OpenCV, OpenGL, Libcud, and GSL libraries
- Some experience multithreading programs on the GPU using CUDA
- Very familiar with various development environments in UNIX/Linux, Windows, and OS X
- Perfectly bilingual in english and spanish (native proficiency)

Honors and Awards

- Upsilon Pi Epsilon Computer Science Honor Society Member
- GAANN Fellowship, Florida State University
- Provost Honor Roll, University of Miami
- Dean's List Honor Roll, University of Miami

Publications

Book Chapters

- **A. Donate** and X. Liu. Three Dimensional Information Extraction and Applications to Video Analysis. Video Search and Mining. Eds. D. Schonfeld, C. Shan, D. Tao, and L. Wang. Springer-Verlag, 2010.

Peer-reviewed Journal Articles

- **A. Donate**, Y. Wang, X. Liu, and E. Collins. Efficient Path Based Stereo Matching with Sub-pixel Accuracy. In *IEEE Transactions on Systems, Man, and Cybernetics, Part B*, 41(1): 183-195, February 2011.
- **A. Donate** and X. Liu. Accurate 3D Human Motion Estimation from Monocular Videos. Currently under review at *IEEE Transactions on Circuits and Systems for Video Technology*.

Peer-reviewed Conference and Workshop Papers

- **A. Donate** and X. Liu. 3D Feature Extraction from Uncalibrated Video Clips. In *1st International Workshop on 3D Video Processing* (In conjunction with ACM MM 2010). Florence, Italy, 2010.
- **A. Donate** and X. Liu. 3D Structure Estimation from Monocular Videos. In *IEEE Workshop on Three Dimensional Information Extraction for Video Analysis and Mining* (In conjunction with CVPR 2010). San Francisco, California, 2010.
- **A. Donate** and X. Liu. Shot Boundary Detection in Videos Using Robust Three-Dimensional Tracking. In *IEEE Workshop on Three Dimensional Information Extraction for Video Analysis and Mining* (In conjunction with CVPR 2010). San Francisco, California, 2010.
- **A. Donate**, Y. Wang, X. Liu and E. Collins. Efficient and Accurate Subpixel Path Based Stereo Matching. *International Conference on Pattern Recognition*. Tampa, Florida, 2008.
- X. Liu, **A. Donate**, M. Jemison, and W. Mio. Kernel Functions for Robust 3D Surface Registration with Spectral Embeddings. *International Conference on Pattern Recognition*. Tampa, Florida, 2008.
- D. Shi, E. Collins, **A. Donate**, X. Liu, B. Goldiez, and D. Dunlap. Design of Human-Aware Robot Motion Planning with Velocity Constraints. *Collaborative Technologies and Systems*. Irvine, California, 2008.
- D. Shi, E. Collins, **A. Donate**, X. Liu, B. Goldiez, and D. Dunlap. Human-Friendly Motion Planning for a High Speed Robot. *Florida Conference on Recent Advances in Robotics (FCRAR)*. Melbourne, Florida, 2008.

- **A. Donate** and E. Ribeiro. Improved Reconstruction of Images Distorted by Water Waves. VISAPP and GRAPP 2006 Special Issue, *Communications in Computer and Information Science (CCIS) 4*, pp. 264-277, Springer-Verlag, Berlin, Heidelberg, 2007.
- **A. Donate** and E. Ribeiro. Viewing Scenes Occluded by Smoke. In *International Symposium on Visual Computing*, Lake Tahoe, Nevada, 2006.
- **A. Donate**, G. Dahme, and E. Ribeiro. Classification of Textures Distorted by Water Waves. *International Conference on Pattern Recognition*, Hong Kong, 2006.
- **A. Donate** and E. Ribeiro. Improved Reconstruction of Images Distorted by Water Waves. In *International Conference of Computer Vision Theory and Applications (VISAPP)*, Setubal, Portugal, 2006. (This publication was chosen by Springer Publishing to be included in the Computer Graphics and Vision Theory and Applications Book I, a collection of the best papers from the VISAPP and GRAPP 2006 conferences)

Selected Research Projects

Human Motion Estimation from Monocular Videos

This project presents a method for estimation of human motion from monocular videos. The approach begins by detecting possible human limbs and estimating the pose of a person in the 2D image frames, then refining this estimate using a human motion model. Next, the pose is extended onto a 3D human model by applying several heuristics that simplify the process. This yields an estimate of the human pose and motion in three dimensions sufficiently powerful to perform activity recognition.

Extraction of 3D Features from Monocular Videos for Video Analysis

The aim of this project is to extract 3D features from monocular video clips in hopes to aid various video analysis tasks. The project presents a technique for tracking a dense set of image features based on local region appearance (SURF, MSER, FAST) as well as the underlying three-dimensional structure of the observed surface, which is estimated by exploiting visible camera motion. By using multi-threading along with GPU acceleration, the system is capable of running in real-time.

Efficient and Accurate Stereo Matching

This algorithm is capable of calculating dense stereo correspondences to provide accurate disparity maps with linear time complexity. The method extends previous work by incorporating sub-pixel measurements on zero-mean normalized cross correlation coefficients, using integral images for efficient calculation.

Surface Registration with Kernel Methods

This work aims to improve surface registration of 3D meshes by incorporating pairwise geodesic distances. Several Kernel functions are applied to such distances in order to make the registration invariant to the elastic deformations inherent with 3D meshes.

People Detection/Tracking for Human-Robot Interaction

This framework uses a stereo camera to detect and track moving people from a robotic platform. The system builds an estimate of the static scene by analyzing the 3D location of features over time, and builds an occupancy map to find moving people. Once detected, people are tracked using Kalman filtering, and this information is used to improve the motion planning of the robot.

Object Detection in Satellite and LIDAR Imagery

This project attempts to classify objects in satellite images by incorporating LIDAR measurements. A k-nearest-neighbor algorithm is used to generate a mesh from LIDAR data, and after registration, each pixel in the satellite image can be classified using support vector machines by using color, texture, and height information.

Segmentation of Coral Reef Images

The purpose of this project is to develop algorithms for segmenting coral reef images in order to accelerate the process of measuring and classifying corals. Image features are measured via partial derivatives and color measurements in the Lab colorspace, then classified via the expectation-maximization algorithm.

Classification of Textures Distorted by Water Waves

This project deals with classification of textures distorted by water waves. The distortion is caused by observing the submerged textures from above of the water. The geometric distortion in the texture images is first removed, then the images are classified using spacial statistical measurements obtained via GLCM on texton representations.

Recovering Images of Scenes Occluded by Smoke

This project focuses on the problem of generating clear views of scenes being occluded by clouds of moving smoke. The amount of occlusion in a given image frame is measured in the Fourier spectrum after applying a high-pass filter to this frequency domain (in order to measure relative edge strength), as well as color saturation information measured in the HSV colorspace.

Recovering Images of Scenes Distorted by Water Waves

This project focuses on the problem of obtaining a clear view of an observed underwater scene as viewed from a camera from outside of the water. The amount of distortion in a given section of an image frame is quantified using frequency domain analysis of the Fourier spectrum after applying high-pass filters, and classified using a multi-stage clustering technique.

Research Presentations

- “3D Feature Extraction from Uncalibrated Video Clips”, *1st International Workshop on 3D Video Processing*. Florence, Italy (October 2010).
- “3D Structure Estimation from Monocular Videos”, *IEEE Workshop on Three Dimensional Information Extraction for Video Analysis and Mining*. San Francisco, CA (June 2010).
- “Extracting 3D Features from 2D Videos”, *FSU Graduate Research Conference*. Tallahassee, FL (May 2010).
- “Efficient and Accurate Subpixel Path Based Stereo Matching”, *International Conference on Pattern Recognition*. Tampa, FL (December 2008).
- “Object Detection in Satellite and LIDAR Images”, *FSU Graduate Research Conference*. Tallahassee, FL (April 2007).
- “Viewing Scenes Occluded by Smoke”, *International Symposium on Visual Computing*. Lake Tahoe, NV (November 2006).
- “Texture Classification and Segmentation of Coral Reef Images”, *Benthic Coral Reef Assessment Workshop on Image Analysis*. Melbourne, FL (June 2006).
- “Improved Reconstruction of Images Distorted by Water Waves”, *International Conference of Computer Vision Theory and Applications*. Setubal, Portugal (February 2006).

Relevant Coursework

Computer Vision*	Pattern Recognition*
Computer Graphics	Advanced Computer Graphics*
Data Structures and Algorithms	Algorithm Analysis
Advanced Algorithms*	Computational Geometry*
Unix System Programming	Concurrent, Parallel, and Distributed Programming*
Logic Design	Artificial Intelligence*
Game Programming	3D Modeling and Animation*
Computer Organization	Advanced Computer Architecture*
Theory of Computing	Formal Languages*
Programming Languages	Compiler Construction*
Principles of Operating Systems	Software Engineering
Data and Computer Communication*	Networking and Security
Filing and Database Systems	Databases*

* denotes graduate-level course