Ernesto Brau

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Education

UNIVERSITY OF ARIZONA — Tucson, AZ
Ph.D., Computer Science, 2013
Advisor: Kobus Barnard

UNIVERSITY OF ARIZONA — Tucson, AZ
M.S., Computer Science, GPA 4.0, 2008

UNIVERSIDAD DE SONORA — Hermosillo, Mexico
B.S., Computer Science, GPA 95.1, 2004

Research Experience

BOSTON COLLEGE — Chestnut Hill, MA
Postdoctoral research fellow, Computer Science, 09/2014 – present
Supervisor: Dr. Hao Jiang

Common action matching. We developed an algorithm to find pairs of matching temporal segments across two videos, where two segments match if they feature the same action. We pose this problem as a generalization of the vertex cover problem, and develop a primal-dual algorithm to solve it. This work is currently under review for publication.

Bayesian 3D human pose estimation. We developed a Bayesian generative model in which a 3D part-based human pose model is projected onto an image. We implement MCMC sampling technique to find best fitting 3D pose and camera to an image of body part labels, obtained via a convolutional neural network classifier. This work is currently under review for publication.

UNIVERSITY OF ARIZONA — Tucson, AZ
Postdoctoral research associate, School of Information, 01/2014 – 09/2014
Supervisor: Dr. Clayton T. Morrison

Recursive sequences of group activity from video. We present a probabilistic generative model for inferring a description of coordinated, recursively structured group activities at multiple levels of temporal granularity based on observations of individuals' trajectories. We develop an MCMC sampling framework for performing joint inference over recursive activity descriptions and assignment of trajectories to groups. This work was supported by the DARPA Mind's Eye program W911NF-10-C-0081, and appeared in AAAI 2016.

UNIVERSITY OF ARIZONA — Tucson, AZ

Graduate research, Computer Science Department, 12/2008 – 12/2013

Advisor: Dr. Kobus Barnard

Bayesian data association for temporal scene understanding. We develop a method for obtaining a 3D understanding of a temporal scene from a single video, e.g., we track objects' positions, orientations and size, and inferring the camera parameters. We introduce a Bayesian generative model in which a 3D scene and camera become the observed image data. Objects in the world are represented by 3D primitives, and their motion is modeled as smooth curves using Gaussian processes. Finally, we also jointly model the data association using the well-known MCMCDA approach. Inference is performed by sampling over the space of associations, using MCMC techniques such as Metropolis-Hastings and hybrid Monte Carlo to efficiently explore the solution space. We successfully applied this approach in two different settings: tracking multiple pollen tubes (CVPR 11) and tracking multiple people in 3D (ICCV 13). An extension to the latter, where we infer where and at whom each person is looking, is currently under review for publication. This work was partly funded by a Graduate Research Assistantship supported by NSF (IOS-0723421).

Camera calibration and perceptual alignment. We calibrated an aligned a system of multiple cameras designed for virtual reality applications. Importantly, the alignment was done with respect to the coordinate system defined by the user's perception of the virtual world.

HEWLETT PACKARD LABS — Palo Alto, CA

Research assistant, 05/2005 – 08/2006

Supervisor: Dr. Cipriano A. Santos, Dr. Kimberly Keeton

Restoring data after disasters. We explore the problem of restoring server operations after a disaster while minimizing data loss and application downtime. My contribution to this work was in the design and implementation of a genetic algorithm that searched the space of possible recovery schedules for a solution that minimized a penalty, given by a combination of data loss and schedule length. This work appeared in EuroSys 2006.

UNIVERSIDAD DE SONORA — Hermosillo, Mexico

Undergraduate researcher, 01/2003 – 05/2003

Supervisor: Dr. Pedro Flores

Genetic algorithms for timetables. We designed and implemented a Genetic Algorithm to automatically generate the course schedule and assign instructors and classrooms for the Department of Mathematics. This work was published in CISCI 2004.

Teaching Experience

BAYESIAN INFERENCE

Computer Science, University of Arizona, Spring 2013

Instructor: Prof. Kobus Barnard

My main responsibility was grading assignments and exams and holding weekly office hours. In addition, I was occasionally required to lead a lecture.

MACHINE LEARNING
School of Information, University of Arizona, Fall 2012
Instructor: Prof. Clayton T. Morrison
My main responsibility was grading assignments and exams, holding weekly office hours, and occasionally leading lectures and designing homework assignments.

DISCRETE MATHEMATICS
Computer Science, University of Arizona, Fall 2006 & Spring 2007
Instructor: Dr. Lester McCann
Graded assignments and exams, held weekly office hours, and lectured twice a week.

Student advising and outreach

LATIN AMERICA SUMMER RESEARCH PROGRAM
University of Arizona, Summer 2013
Supervised undergraduate student researching the use of color cues in 3D person tracking.

KEEP ENGAGING YOUTH IN SCIENCE
University of Arizona, Summer 2011
Supervised high school student who explored inference approaches for understanding pollen tube behavior from confocal images.

UNDERGRADUATE RESEARCH
University of Arizona, 2010 – 2013
Co-supervised several undergraduate students performing research, some of whom made significant contributions and became co-authors on published work (e.g., CVPR 11).

C++ WORKSHOPS
University of Arizona, Summers 2010 – 2013
Co-organized and led C++ workshops designed for students and faculty members interested in collaborating with our research group.

Software

Co-maintainer and active contributor of *libergo,* a C++ template library for MCMC sampling hosted on `https://github.com/ksimek/libergo`.

Co-maintainer and active contributor of the *KJB Library*, a C/C++ library for linear algebra, image processing, and machine learning. Available upon request.

Publications

[7] Brau, E., Dawson, C., Carrillo, A., Sidi, D., Morrison, C. T., "Bayesian Inference of Recursive Sequences of Group Activities from Tracks." *AAAI Conference on Artificial Intelligence (2016).* February 2016.

[6] Guan, J., Simek, K., Brau, E., Morrison, C., Butler, E., Barnard, K., "Moderated and Drifting Linear Dynamical Systems." In *Proceedings of The 32nd International Conference on Machine Learning (ICML)*. July 2015.

[5] Brau, E., Guan, J., Simek, K., Del Pero, L., Dawson, C. R., & Barnard, K., "Bayesian 3D Tracking from monocular video." In *Computer Vision (ICCV), 2013 IEEE International Conference on.* December 2013.

[4] Brau, E., Barnard, K., Palanivelu, R., Dunatunga, D., Tsukamoto, T., & Lee, P., “A generative statistical model for tracking multiple smooth trajectories.” In *Computer Vision and Pattern Recognition (CVPR), 2011 IEEE Conference on.* June 2011.

[3] Pero, L. D., Guan, J., Brau, E., Schlecht, J., & Barnard, K., “Sampling bedrooms.” In *Computer Vision and Pattern Recognition (CVPR), 2011 IEEE Conference on*. June 2011.

[2] Keeton, K., Beyer, D., Brau, E., Merchant, A., Santos, C., & Zhang, A., “On the road to recovery: restoring data after disasters.” *ACM SIGOPS Operating Systems Review.* April 2006.

[1] Flores, P., Brau, E., Monteverde, J., Salazar, N., Figueroa, J., Cadena, E., & Lizárraga, C., “Experimentos con Algoritmos Genéticos para resolver un problema real de Programación Maestros-Horarios-Cursos.” *Revista iberoamericana de sistemas, cibernética e informática.* July 2004.