

# Vijai T. Jayadevan



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## EDUCATION

- 2014 – PRESENT **Doctor of Philosophy**  
Electrical & Computer Engineering  
*Purdue University, West Lafayette, USA*
- 2011 – 2013 **Master of Science**  
Electrical & Computer Engineering  
*The University of Arizona, Tucson, USA*
- 2004 – 2008 **Bachelor of Technology**  
Electronics & Communication  
*Cochin University, Kochi, India*

## WORK EXPERIENCE

*Purdue University* CURRENT, FROM JAN 2015  
**Graduate Research Assistant**

The focus of my work is on understanding the role of priors (like symmetry, compactness, planarity etc.) in three-dimensional (3D) visual perception and in using this information to develop better computer vision algorithms.

*Purdue University* AUG 2018 – MAY 2019  
**Graduate Teaching Assistant**

As a teaching assistant for Linear Circuit Analysis II (ECE 202), my responsibilities included holding regular office hours to help students understand the material and creating solutions for home-works and exams.

*Elegant Thought* MAY 2013 – AUG 2013  
**Software Engineering Intern**

Worked on developing a complete website using ASP .Net MVC 4 framework for PricewaterhouseCoopers (PwC). A Windows service which runs in the background to automate the processing of some data files was also developed.

*The University of Arizona* AUG 2011 – DEC 2013  
**Graduate Research Assistant**

The research work involved the development of an algorithm for predicting the intermittency in solar irradiance caused due to clouds by analyzing the pictures taken by a camera tracking the sun. It involved image segmentation and non-rigid object tracking in images.

*Tata Consultancy Services* AUG 2008 – MAY 2011  
**Systems Engineer**

Developed economic and statistical software applications for International Monetary Fund (IMF). Gained experience in developing web and desktop applications as well as windows services using coding languages like C# and VisualBasic.

## SUMMARY OF STRENGTHS

- More than seven years of research experience in computer vision.
- Hands on experience in transforming research problems into appropriate optimization problems and then solving them using numerical methods. Experience in accurately implementing several state of the art research papers.
- Ability to quickly learn and apply new concepts/skills.
- Excellent communication skills (both oral and written) and strong work ethic.

## TECHNICAL SKILLS

LANGUAGES	Python, C++, C#, MATLAB, Julia
WEB	HTML, CSS, .NET Framework, Javascript (Three.js)
OTHER	Git, Qt, Unity, VIM, TensorFlow, Numba

## DOCTORAL RESEARCH

**“Biologically Inspired Priors for Computer Vision: Understanding the Priors Employed by the Human Visual System and Using them to Improve Computer Vision and Computer Graphics Algorithms”**

Advisors: Dr. Edward J. Delp and Dr. Zygmunt Pizlo

The focus of my work is on understanding the role of priors in three-dimensional (3D) visual perception and in using this information to develop better computer vision and computer graphics algorithms. 3D vision is an ill-posed inverse problem. The formation of the 2D image of a 3D shape/scene is the forward problem, and inferring the 3D shape/scene from the image is the inverse problem. The ill-posedness is related to the fact that any given 2D image is consistent with infinitely many 3D interpretations. In order to produce a unique and ideally correct interpretation, one has to impose constraints (aka priors) on the family of possible interpretations.

Symmetry, planarity, compactness etc., are some priors used by the visual system to deal with the ill-posedness of the problem. In my work, I attempt to better understand the role of these priors through psychophysical experiments. I'm also interested in finding ways to employ such priors to improve computer vision algorithms. Specifically, I explore the role of reflection symmetry in 3D reconstruction of shapes from a single image and the role of translational symmetry in semantic labelling of 3D point clouds.

## MASTER'S RESEARCH

### "Forecasting Solar Power Intermittency Using Ground Based Cloud Imaging with a Focus on Cloud Image Segmentation"

Advisors: Dr. Jeffrey J. Rodriguez and Dr. Alexander D. Cronin

Intermittency in solar power due to passing clouds limits the adoption of solar power by utility companies and industry because they require reliable, predictable power generation. Methods used to counter the problem of intermittency, like interconnecting geographically dispersed photovoltaic (PV) systems, using dispatchable spinning reserves, energy storage, smart grids etc. require accurate forecasting of PV power output for safe and efficient operation. For instance, utility operators require a ten-minute warning to bring spinning reserves online. Forecasting at multiple timescales is valuable for utility operators and plant owners. Day-ahead forecasts are needed to better determine pricing in the energy market. Hour-ahead and shorter time-scale forecasts are valuable for electric grid operators to schedule spinning reserves. Image analysis algorithms applied to images acquired using a Ground-based sky imaging (GBSI) systems have shown promise in making reliable intra-hour power forecasts. This thesis developed novel image analysis techniques to produce reliable intra-hour power forecasts. We setup a GBSI system at the Tucson Electric Power solar power test yard, which unlike most other such systems tracks the sun. The various modules involved in producing a power forecast, namely, cloud detection, motion estimation and cloud advection were developed. This include the development of a new feature for enhancing the contrast between cloud and sky pixels in images and a novel conditional random field (CRF) based method, which attains very high accuracy for cloud detection. The utility of using the GBSI set up for dealing with intermittency was demonstrated by the results for the prediction of solar power output.

## RELEVANT GRADUATE COURSEWORK

Digital Signal Processing	Computational Methods in Optimization
Biomedical Imaging	Probability & Statistics for Optics
Digital Image Processing	Advanced Linear Systems Theory
Computer Vision	Advanced Computer Graphics
Real Analysis	Computational Models and Methods
Model Based Imaging	Advanced Topics in Visual Perception
Applied Linear Algebra	Numerical Linear Algebra
Digital Image Analysis	Statistical Machine Learning

## SELECTED ACADEMIC PROJECTS

- *Shadow Rendering Algorithm (Spring 16)*: Implemented an efficient, high quality soft shadow rendering algorithm. The entire graphics rendering pipeline was developed from scratch in C++.
- *Computer Vision Algorithms (Fall 2014)*: Implemented and tested, in C++, the following algorithms: (1) Zhang's calibration algorithm to estimate intrinsic and extrinsic camera parameters (2) the normalized eight-point algorithm to estimate the fundamental matrix and perform 3D reconstruction from multiple views (3) the cascaded AdaBoost classifier for object detection.
- *JPEG Encoder (Spring 2014)*: Implemented a baseline JPEG encoder in ANSI C.
- *Monte Carlo simulation (Spring 2012)*: Implemented a Monte Carlo simulation project to find out the probability law on angle of divergence from initial direction of photons traveling through a scattering media, as part of a course on probability.

## RESEARCH INTEREST

Computer Vision, Visual Perception, Computer Graphics, Machine Learning, Image Processing, Inverse Problems, Optimization.

## JOURNAL PUBLICATIONS

**V. Jayadevan**, T. Sawada, E. Delp, and Z. Pizlo, "Perception of 3D symmetrical and nearly symmetrical shapes," *Symmetry*, vol. 10, no. 8, p. 344, 2018

A. Michaux, V. Kumar, **V. Jayadevan**, E. Delp, and Z. Pizlo, "Binocular 3D object recovery using a symmetry prior," *Symmetry*, vol. 9, no. 5, p. 64, 2017

A. Michaux, **V. Jayadevan**, E. J. Delp, and Z. Pizlo, "Figure-ground organization based on three-dimensional symmetry," *Journal of Electronic Imaging*, vol. 25, no. 6, p. 061606, 2016

**V. Jayadevan**, J. J. Rodriguez, and A. D. Cronin, "A new contrast-enhancing feature for cloud detection in ground-based sky images," *Journal of Atmospheric and Oceanic Technology*, vol. 32, no. 2, pp. 209–219, 2015

## CONFERENCE PUBLICATIONS

**V. Jayadevan**, A. Michaux, E. Delp, and Z. Pizlo, "3D shape recovery from real images using a symmetry prior," in *IS and T International Symposium on Electronic Imaging Science and Technology, Computational Imaging XV*, 2017, pp. 106–115

V. P. Lonij, **V. Jayadevan**, A. E. Brooks, J. J. Rodriguez, K. Koch, M. Leuthold, and A. D. Cronin, "Forecasts of PV power output using power measurements of 80 residential PV installs," in *2012 38th IEEE Photovoltaic Specialists Conference*. IEEE, 2012, pp. 003 300–003 305

**V. Jayadevan**, J. J. Rodriguez, V. P. Lonij, and A. D. Cronin, "Forecasting solar power intermittency using ground-based cloud imaging," in *World Renewable Energy Forum, WREF 2012, Including World Renewable Energy Congress XII and Colorado Renewable Energy Society (CRES) Annual Conference*, 2012, pp. 2100–2106

## OTHER PUBLICATIONS

**V. Jayadevan**, J. J. Rodriguez, and A. D. Cronin, "A conditional random field model for context aware cloud detection in sky images," *arXiv preprint arXiv:1906.07383*, 2019

**V. Jayadevan**, E. Delp, and Z. Pizlo, "Skeleton extraction from 3D point clouds by decomposing the object into parts," (*In Preparation*), 2019

**V. Jayadevan**, T. Sawada, E. Delp, and Z. Pizlo, "Monocular and binocular recovery of 3D symmetrical and near-symmetrical shapes," *Journal of Vision*, vol. 18, no. 10, pp. 719–719, 2018

**V. Jayadevan**, A. Cronin, V. Lonij, S. Jones, and G. Torres, “Looking to the sky to predict solar power intermittency,” in *APS Four Corners Section Meeting Abstracts*, 2011

V. Lonij, S. Orsburn, A. Salhab, E. Kopp, A. Brooks, **V. Jayadevan**, J. Greenberg, M. St Germaine, N. Allen, S. Jones *et al.*, “The Tucson Electric Power solar test yard,” in *APS Four Corners Section Meeting Abstracts*, 2011

## REFERENCES

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### **Dr. Edward J. Delp**

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*Purdue University*  
  
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### **Dr. Zygmunt Pizlo**

POSITION Professor  
EMPLOYER Department of Cognitive Sciences  
*University of California, Irvine*  
  
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