

# PoLin Lai

3678 Watsaka Ave. Apt.6  
Los Angeles, CA 90034

<http://biron.usc.edu/~polinlai/>

POLINLAI@USC.EDU

Cell: 310-254-5471

## Objective

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Full-time research engineer position, video/image processing and compression

-- Self-motivated to contribute in teamwork to identify, analyze, and solve problems

## Education

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Ph.D., Electrical Engineering (Multiview video coding, Advisor: Antonio Ortega) 08/2004 ~ Fall 08  
University of Southern California (USC), Los Angeles, CA, USA (Expected)

M.S., Electrical Engineering (Signal Processing) *Major GPA: 3.97* 08/2002 ~ 05/2004  
University of Southern California (USC), Los Angeles, CA, USA

B.S., Electrical Engineering, *Major GPA: 3.87, Upper Division GPA: 3.96* 09/1998 ~ 06/2002  
National Taiwan University (NTU), Taipei, Taiwan

## Professional Experiences

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### Research Assistant

05/2005 ~ present

*Signal and Image Processing Institute (SIPI), USC*

#### **Multiview video coding\* (MVC)**

##### Adaptive reference filtering (ARF), focus mismatch related work

- Analyze focus mismatch based on camera parameters and scene depths/disparity
- Design adaptive reference filtering approach (ARF) for localized focus mismatches
  - MVC cross-view: Disparity based approach, up to 0.8dB gain over H.264 (*VCIP 07, CSVT 07*)
  - Monoscopic video: Clustering local mismatch kernels, up to 1dB over H.264 (*ICASSP 07*)
- Study compensation effects by ARF and illumination compensation (IC) techniques
  - Develop combined coding algorithm with ARF/IC to jointly treat focus and illumination mismatches in MVC cross-view, up to 1.3dB gain over H.264 (*Trans. CSVT 07*)
- Correlation analysis of ARF filters across time considering depth-composition of the scene
  - Evaluate rate-distortion (RD) performance of ARF across views
  - Present techniques to reduce ARF complexity by 65%~80%, only 0.05dB degradation (*VCIP 08*)
- Investigate the interaction between ARF filter estimation and bidirectional search
  - Propose bidirectional ARF for MVC cross-view, up to 0.8 dB gain over H.264 B-slice (*ICIP 08*)
- Explore the potential of extending ARF to video with localized directional motion blur

##### Other contributions

- Analyze motion/disparity in multiview video → Efficient search schemes for MVC (*VCIP 06*)
- Create “disparity skip mode” by reusing disparity information, up to 0.15dB gain for generic MVC structure with motion/disparity compensations (*MPEG m12969, Jan. 2006*)
- Investigate the relationship between motion fields and residue images across neighboring views
- Study RD performance of MVC by considering view dependency and partial decoding
  - Propose new RD metric for specific multiview application scenarios (*MPEG m13318, Apr.2006*)

\*Collaboration with THOMSON Corporate Research

## Research Intern

THOMSON Corporate Research, Princeton, NJ

Summer 2006

Mentors: Yeping Su and Peng Yin, Advanced Compression Team (Manager: Cristina Gomila)

- Identify and study focus mismatches exhibit in digital video content
- Develop adaptive reference filtering (ARF) approach for video coding with focus mismatches
- Explore classification techniques to identify localized focus mismatches with video frames
- Integrate ARF framework into H.264/AVC reference code JM

THOMSON Corporate Research, Princeton, NJ

Summer 2007

Mentors: Purvin Pandit and Peng Yin, Advanced Compression Team (Manager: Cristina Gomila)

- Complexity analysis and reduction for ARF in MVC inter-view coding
- Explore approaches to extend ARF to bidirectional disparity compensation (Patent filed)
- JVT activities: Propose ARF as a coding tool for MVC  
Establish core experiments (CE) for ARF
- Investigate adaptive filter design by leveraging the predefined H.264/AVC interpolation filters
- Exploit regional disparity information to improve “motion skip mode” in MVC (Patent filed)

\* “Motion skip mode” is a coding tool adopted in JVT Joint Multiview Video Module (JMVM) reference software

## Teaching Assistant

Spring 2006, 2007

USC EE434L, 586L: Advanced Digital Signal Processing Design Lab.

(Real-time digital signal processing with TI DSP board and Code Composer Studio)

- Assist students in assignments and final projects
- Design introductory assignments, evaluate the final projects

## Journals/conferences Paper Review

- 3 IEEE Transaction CSVT paper review, 2 IEEE ICIP paper review

## Publications

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- **P. Lai**, A. Ortega, P. Pandit, P. Yin, C. Gomila, “Adaptive Reference Filtering for Bidirectional Disparity Compensation with Focus Mismatches”, accepted, to appear in *Proc. IEEE International Conference on Image Processing (ICIP)*, San Diego, CA, Oct. 2008
- **P. Lai**, A. Ortega, P. Pandit, P. Yin, and C. Gomila, "Focus Mismatches in Multiview Systems and Efficient Adaptive Reference Filtering for Multiview Video Coding," in *Proc. SPIE Visual Communications and Image Processing (VCIP)*, San Jose, CA, Jan. 2008
- J. H. Kim, **P. Lai**, J. Lopez, A. Ortega, Y. Su, P. Yin, and C. Gomila, "New Coding Tools for Illumination and Focus Mismatch Compensation in Multiview Video Coding," in *IEEE Trans. Circuits and Systems for Video Technology (CSVT)*, **Special Issue on Multiview Video Coding**, vol. 17, no. 11, pp. 1519–1535, Nov 2007
- **P. Lai**, Y. Su, P. Yin, C. Gomila, and A. Ortega, “Adaptive Filtering for Video Coding with Focus Change”, in *Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)*, Honolulu, Hawaii, Apr. 2007, pp. I.661–I.664
- (*Invited paper*) **P. Lai**, Y. Su, P. Yin, C. Gomila and A. Ortega, "Adaptive Reference Filtering for Cross-view Prediction in Multi-view Video Coding," in *Proc. SPIE Visual Communications and Image Processing (VCIP) – Special Session: Next Generation Video Coding Techniques*, Jan. 2007.
- **P. Lai** and A. Ortega, "Predictive Fast Motion/Disparity Search for Multiview Video Coding," in *Proc. SPIE Visual Communications and Image Processing (VCIP)*, San Jose, CA, Jan. 2006.

## **Patents**

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- Thomson Licensing, **P. Lai**, Y. Su, P. Yin, C. Gomila, "Methods and Apparatus for Adaptive Reference Filtering" *Pub. No. WO/2008/010929*, 01/24/2008 (60/807,645 07/18/2006 US)

## **JVT/MPEG Contributions**

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- **P. Lai**, P. Purvin, P. Ying, D. Tian, and C. Gomila, "CE2: Adaptive Reference Filtering for MVC," *JVT Document Y041*, Oct. 2007; *JVT Document Z020*, Jan. 2008
- **P. Lai**, A. Ortega, P. Purvin, P. Ying, and C. Gomila, "Decoder complexity analysis for Adaptive Reference Filtering for MVC," *JVT Document X060*, Jun. 2007
- **P. Lai**, A. Ortega, P. Purvin, P. Ying, and C. Gomila, "Adaptive reference filtering for MVC," *JVT Document W065*, Apr. 2007
- **P. Lai**, J.H. Kim, A. Ortega, Y. Su, P. Purvin, and C. Gomila, "New rate-distortion metrics for MVC considering cross-view dependency," *MPEG Document m13318*, Apr. 2006
- Y. Su, P. Yin, C. Gomila, J.H. Kim, **P. Lai**, and A. Ortega, "Thomson's response to MVC Call for Proposal," *MPEG Document M12969/2*, Jan. 2006

## **Course projects**

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- Intruders Tracking for Camera Surveillance System with Robustness to Lighting Variation (Spring 2004, Term project of Advanced DSP Design Lab., USC)
- Spatially Scalable Stereo Image Coding using Wavelet-based Disparity Prediction (Fall 2003, Term project of Wavelets, USC)
- Analysis and Cancellation of Environmental Noise with Adaptive Signal Processing (Fall 2003, Term project of Immersive Signal Processing, USC)
- Correlation Analysis of Speckle Distribution in Ultrasonic Images (Fall 2000~Spring 2001, Directed Research, NTU Ultrasonic Imaging Lab)

## **Selected Course Work**

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Random Process in Engineering, Estimation Theory, Adaptive Signal Processing, Wavelets, Mathematical Pattern Recognition, Computer Vision, Statics for Engineers, Multimedia Data Compression, Multimedia System Design, Advanced DSP Design Lab

## **Software Skills**

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- C/C++, MATLAB, TI code composer studio (CCS)
- Familiar with H.264 reference code JM (C based) and JMVM (Multiview video module, C++ based)

## **Honors**

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- USC School of Engineering, Doctoral Scholarship 2004
- GARMIN Corporation Scholarship (Junior year, NTU) 2001

## **Additional Information:**

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- US Citizen