

Fan Zhai

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Video Technology Group
DSP Systems, ASP
Texas Instruments Inc.
Dallas, TX 75243

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|--------------------------------|--|--|
| Education | Northwestern University, Evanston, IL Dept. Electrical & Computer Engineering <i>Major:</i> Signal and Imaging Processing <i>Dissertation:</i> "Cross-layer resource allocation for video transmission over packet lossy networks" <i>Advisors:</i> Dr. Thrasyvoulos N. Pappas (IEEE Fellow) and Dr. Aggelos K. Katsaggelos (IEEE Fellow) | 09/1999–05/2004 <i>Ph.D. in Electrical Engineering</i> |
| | Northwestern University, Evanston, IL Dept. Mechanical Engineering <i>Major:</i> Theoretical and Applied Mechanics | 09/1998–09/1999 <i>Ph.D. program</i> |
| | Nanjing University, P.R.China Dept. Electronic Science & Engineering <i>Major:</i> Ultrasonic Electronics <i>Thesis:</i> "Implementation of Gigahertz SAW filters using harmonic interdigital transducers" | 09/1996–06/1998 <i>M.S. in Electrical Engineering</i> |
| | Nanjing University, P.R.China Dept. Electronic Science & Engineering <i>Major:</i> Electronics & Information System <i>Minor:</i> Computer Science <i>Thesis:</i> "Theory and application of Digital Phase-Locked Loop (PLL) dealing with video scrambling and descrambling system" | 09/1992–06/1996 <i>B.S. in Electrical Engineering</i> |
| Professional Experience | Texas Instruments, Dallas, TX Video Technology Group, DSPS, ASP | 07/2004–Present <i>Systems Engineer</i> |
| | <ul style="list-style-type: none">• Lead Architect of De-interlacer: Developed the first high-performance de-interlacing algorithm used for HDTV in TI (including motion detection, noise reduction, edge-directed interpolation, and film mode detection), implemented such algorithm in bit-accurate C-model using SystemC, and designed architecture of the de-interlacer including memory management and software/hardware partition for TI's HDTV processor SoC (System on Chip); TI Parts: TVP9009, TVP9010, Panther, Netra, OMAP4• Lead Architect of Artifacts/Noise Reduction: Developed high quality ringing artifacts reduction and spatial/temporal noise reduction algorithms for TI's video processors; TI Parts: TVP9009, Netra• Took core responsibility in algorithm development and system and architecture design for TI's next generation display processing IP• Played a key role in IP portfolio management for TI's next generation video display processing technology• Researched image/video signal processing algorithms in digital TV, including motion detection, scaling, de-interlacing, noise reduction, artifacts reduction, edge enhancement, color processing, and contrast control• Researched various algorithms for low power and highly optimal H.264 video decoder, video transcoding, and blocking artifacts reduction; carried out performance evaluation; proposed recommendations on improvement, software/hardware partition, and design architecture; implemented in bit-accurate C-model• Mentored Ph.D. students investigating video summarization and joint source-channel coding for video communications | |

Northwestern University, Evanston, IL
Dept. Electrical & Computer Engineering

09/1999–07/2004
Research Assistant

- Researched image and video compression, multimedia signal processing/transmission, joint source-network design for video streaming systems
- Focused on cross-layer resource allocation optimization in multimedia communication systems, and techniques providing rate-distortion optimized unequal error protection for multimedia streaming over lossy networks
- Developed an adaptive mode selection scheme in a motion-compensated wavelet video encoder to enhance the compression efficiency

Texas Instruments, Dallas, TX
Digital Video Department

06/2001–09/2001
Co-op

- Surveyed and evaluated the performance of deinterlacing algorithms for video signal
- Implemented and optimized different noise reduction and motion detection techniques for TI's video decoder prototype

Texas Instruments, Dallas, TX
Digital Video Department

06/2002–09/2002
Co-op

- Took major responsibility for algorithm research, architecture design, and simulation for the project of three-dimensional luma/chroma separation (3DYC) using motion estimation
- Evaluated the feasibility and performance of 3DYC separation using motion estimation
- Studied the performance of different 2-D and 3-D comb filters and implemented an adaptive 3-D comb filter for 3DYC using motion detection in the composite video domain

Nanjing University, Nanjing, P.R.China
Dept. Electronic Science & Engineering

09/1996–06/1998
Research Assistant

Project: "Research on High Frequency Surface Acoustic Wave (SAW) Filter Design"

- Designed and implemented Gigahertz SAW filters adaptive to conventional manufacturing processes using harmonic interdigital transducers

Purple Mountain Observer
Academia Sinica, P.R.China

11/1995–08/1996
Co-op

Project: "Video Scrambling and Descrambling System for CATV"

- Designed and implemented noise reduction circuits, a high-precision power supply, the computer interface, and a reliable narrow band digital phase-locked loop (DPLL)

**Teaching
Experience**

Northwestern University, Evanston, IL
Dept. Electrical & Computer Engineering

01/2000–06/2002
Teaching Assistant

- Spring, '01-'02 "Introduction to Electrical Engineering"
- Winter, '01-'02 "Introduction to Electrical Engineering"
- Fall, '01-'02 "Introduction to Computer Engineering"
- Spring, '00-'01 "Introduction to Electrical Engineering"
- Winter, '00-'01 "Introduction to Electrical Engineering"
- Fall, '00-'01 "Digital Signal Processing"
- Spring, '99-'00 "Fundamentals of Circuits"
- Winter, '99-'00 "Introduction to Electrical Engineering"
- Fall, '99-'00 "Digital Signal Processing"

Nanjing University, Nanjing, P.R. China
Dept. Electronic Science & Engineering

09/1997–01/1998
Teaching Assistant

- Fall, '97-'98 "Numerical Methods"

Publications

Book

- **F. Zhai** and A. K. Katsaggelos, “Joint Source-Channel Video Transmission,” In Synthesis Lectures on Image, Video, and Multimedia Processing Series, Series Editor: Al Bovik, Morgan & Claypool Publishers, Sept. 2007.

Book Chapter

- **F. Zhai**, Y. Eisenberg, and A. K. Katsaggelos, “Joint source-channel coding for video communications,” *Handbook of Image and Video Processing*, 2nd Edition, edited by Al Bovik, Elsevier Academics Press, June 2005.

Journal Articles

- Y. Eisenberg, **F. Zhai**, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “VAPOR: Variance-aware per-pixel optimal resource allocation,” *IEEE Trans. Image Processing*, vol.15, pp.289-299, Feb. 2006.
- **F. Zhai**, Y. Eisenberg, R. Berry, and A. K. Katsaggelos, “Rate-distortion optimized hybrid error control for real-time packetized video transmission,” *IEEE Trans. Image Processing*, vol.15, pp.40-53. Jan. 2006.
- H. Wang, **F. Zhai**, Y. Eisenberg, and A. K. Katsaggelos, “Cost-distortion optimal unequal error protection for object-based video communications over lossy networks,” *IEEE Trans. Circuit Syst. Video Technol*, vol.15, pp. 1505-1516, Dec. 2005.
- **F. Zhai**, C. E. Luna, Y. Eisenberg, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “Joint source coding and packet classification for real-time video transmission over differentiated services networks,” *IEEE Trans. Multimedia*, vol. 7, pp. 716-726, Aug. 2005.
- A. K. Katsaggelos, **F. Zhai**, Y. Eisenberg, and R. Berry, “Energy-efficient video coding and delivery,” *IEEE Wireless Communications*, vol.12, pp.24-30, Aug. 2005, Invited paper.
- **F. Zhai**, Y. Eisenberg, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “Joint source-channel coding and power adaptation for energy efficient wireless video communications,” *Signal Processing: Image Communications*, vol. 20/4, pp.371-387, April 2005.
- A. K. Katsaggelos, Y. Eisenberg, **F. Zhai**, R. Berry, and T. N. Pappas, “Advances in efficient resource allocation for packet-based video transmission,” *Proceedings of the IEEE*, vol 93, pp. 135-147, Jan. 2005.
- **F. Zhai**, D. Zhang, Y. Li, and Z. Xie, “Implementation of Gigahertz SAW filters using quasi harmonic interdigital transducers,” *Applied Acoustics*, vol. 18, no. 2, pp. 6-10, Feb. 1999.

Conference Proceedings

- **F. Zhai**, Z. Li, and A. K. Katsaggelos, “Joint source coding and data rate adaptation for multi-user wireless video transmission,” *IEEE Int. Conf. on Multimedia and Expo*, Beijing, China, July 2007.
- E. Maani, **F. Zhai**, and A. K. Katsaggelos, “Optimal mode selection and channel coding for video transmission over wireless channels using H.264/AVC,” *IEEE Int. Conf. Acoustics, Speech, and Signal Processing*, Honolulu, Hawaii, USA, April 2007.
- P. Pahalawatta, Z. Li, **F. Zhai**, and A. K. Katsaggelos, “Rate-distortion optimization for Internet video summarization and transmission,” *Proc. IEEE International Workshop on Multimedia Signal Processing (MMSp’05)*, Shanghai, China, Oct. 2005.
- Z. Li, **F. Zhai**, and A. K. Katsaggelos, “Video summarization for energy-efficient wireless streaming,” *Proc. SPIE Visual Communication and Image Processing (VCIP’05)*, Beijing, China, July 2005.
- Z. Li, **F. Zhai**, A. K. Katsaggelos, and T. N. Pappas, “Energy efficient video summarization and transmission over wireless channel with multiple modulation and coding schemes,” *Proc. SPIE Image and Video Communications and Processing*, San Jose, CA, Jan. 2005.

- P. Pahalawatta, Z. Li, **F. Zhai**, and A. K. Katsaggelos, “Rate-distortion optimized video summary generation and transmission over packet lossy networks,” *Proc. SPIE Image and Video Communications and Processing*, San Jose, CA, Jan. 2005.
- **F. Zhai**, Y. Eisenberg, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “An integrated joint source-channel coding framework for video transmission over packet lossy networks,” *Proc. IEEE International Conf. Image Processing (ICIP’04)*, Singapore, Oct. 2004.
- H. Wang, **F. Zhai**, Y. Eisenberg, and A. K. Katsaggelos, “Optimal object-based video communications over differentiated services networks,” *Proc. IEEE International Conf. Image Processing (ICIP’04)*, Singapore, Oct. 2004.
- H. Wang, Y. Eisenberg, **F. Zhai**, and A. K. Katsaggelos, “Joint object-based video encoding and power management for energy efficient wireless video communications,” *Proc. IEEE International Conf. Image Processing (ICIP’04)*, Singapore, Oct. 2004.
- E. Soyak, Y. Eisenberg, **F. Zhai**, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “Channel modeling and its effect on the end-to-end distortion in wireless video communications,” *Proc. IEEE International Conf. Image Processing (ICIP’04)*, Singapore, Oct. 2004.
- **F. Zhai**, Y. Eisenberg, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “Rate-distortion optimized hybrid error control for real-time packetized video transmission,” *Proc. IEEE Int. Conf. Communications (ICC’04)*, vol. 3, pp. 1318-1322, Paris, France, June 2004.
- C. Costa, Y. Eisenberg, **F. Zhai**, and A. K. Katsaggelos, “Energy efficient wireless transmission of MPEG-4 Fine Granular Scalable video,” *Proc. IEEE Int. Conf. Communications (ICC’04)*, vol. 5, pp. 3096-3100, Paris, France, June 2004.
- **F. Zhai**, Y. Eisenberg, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “Rate-distortion optimized product code forward error correction for video transmission over IP-based wireless networks,” *Proc. IEEE Int. Conf. Acoustics, Speech, and Signal Processing (ICASSP’04)*, vol. 5, pp. 857-860, Montreal, Canada, May 2004.
- **F. Zhai** and T. N. Pappas, “Motion-compensated wavelet video coding using adaptive mode selection,” *Proc. SPIE Visual Communication and Image Processing (VCIP’04)*, San Jose, CA, Jan. 2004.
- Y. Eisenberg, **F. Zhai**, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “Quality metrics for measuring end-to-end distortion in packet-switched video communication systems,” *Human Vision and Electronic Imaging IX*, Proc. SPIE, vol. 5292, San Jose, CA, Jan. 2004.
- **F. Zhai**, Y. Eisenberg, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “Joint source-channel coding and power allocation for energy efficient wireless video communications,” *Proc. 41st Allerton Conf. Communication, Control, and Computing*, Oct. 2003.
- **F. Zhai**, Y. Eisenberg, C. E. Luna, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “Packetization schemes for forward error correction in Internet video streaming,” *Proc. 41st Allerton Conf. Communication, Control, and Computing*, Oct. 2003.
- **F. Zhai**, C. E. Luna, Y. Eisenberg, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “A novel cost-distortion optimization framework for video streaming over differentiated services networks,” *Proc. IEEE International Conf. Image Processing (ICIP’03)*, vol. 2, pp. 293-296, Barcelona, Spain, Sept. 2003.
- Y. Eisenberg, **F. Zhai**, C. E. Luna, T. N. Pappas, R. Berry, and A. K. Katsaggelos, “Variance-aware distortion estimation for wireless video communications,” *Proc. IEEE International Conf. Image Processing (ICIP’03)*, vol. 1, pp. 89-92, Barcelona, Spain, Sept. 2003.
- **F. Zhai**, R. Berry, T. N. Pappas, and A. K. Katsaggelos, “A rate-distortion optimized error control scheme for scalable video streaming over the Internet,” *Proc. IEEE Int. Conf. Multimedia and Expo (ICME’03)*, vol. 2, pp. 125-128, Baltimore, MD, July 2003.
- **F. Zhai** and D. Zhang, “Implementation of Gigahertz SAW filters dual harmonic interdigital transducers (DHIDTs),” *National Piezoelectric Crystal Technique Conference*, Beijing, P.R.China, Sept. 1997.

- **F. Zhai** and D. Zhang, “Dual harmonic interdigital transducers (DHIDT),” *IEEE Frequency Control Symposium*, pp. 845-851, Orlando, FL, May 1997.

Patents

- **F. Zhai** and K. Renner, “Processing a video signal using motion estimation to separate luminance information from chrominance information in the video signal”, Texas Instruments, US 7,046,306 B2, May 16, 2006.
- **F. Zhai** and W. Chang, “Interlaced-to-progressive video processing”, Texas Instruments, pending.
- **F. Zhai** and W. Chang, “Motion detection for interlaced video”, Texas Instruments, pending.
- **F. Zhai** and W. Chang, “Film mode detection”, Texas Instruments, pending.
- **F. Zhai** and W. Chang, “Bad video edit detection”, Texas Instruments, pending.
- **F. Zhai**, “Method and apparatus of ringing artifacts reduction for compressed video signals”, Texas Instruments, pending.

Presentations

Conference Presentations

- “Hierarchical de-interlacing in TVP9010: A high-end de-interlacer,” *TI Symposium on Multimedia Algorithms and Systems*, Dallas, TX, Aug. 2007.
- “Joint source coding and data rate adaptation for multi-user wireless video transmission,” *IEEE Int. Conf. on Multimedia and Expo*, Beijing, China, July 2007.
- “Rate-distortion optimized product code forward error correction for video transmission over IP-based wireless networks,” *IEEE Int. Conf. Acoustics, Speech, and Signal Processing (ICASSP’04)*, Montreal, Canada, May 2004.
- “Motion-compensated wavelet video coding using adaptive mode selection,” *SPIE Visual Communication and Image Processing (VCIP’04)*, San Jose, CA, Jan. 2004.
- “Joint source-channel coding and power allocation for energy efficient wireless video communications,” *41st Allerton Conf. Communication, Control, and Computing*, Monticello, IL, Oct. 2003.
- “Packetization schemes for forward error correction in Internet video streaming,” *41st Allerton Conf. Communication, Control, and Computing*, Monticello, IL, Oct. 2003.
- “A rate-distortion optimized error control scheme for scalable video streaming over the Internet,” *IEEE Int. Conf. Multimedia and Expo (ICME’03)*, Baltimore, MD, July 2003.

Image and Video Lab Group Meeting and ECE Advisory Board Poster Session

- “Advances in wavelet-based image and video coding,” *Image and Video Lab Group Meeting*, Northwestern University, Dec. 2003.
- “Optimal resource allocation in video communication systems,” *ECE Advisory Board Poster Session*, Northwestern University, Oct. 2003.
- “Cross layer resource allocation for video streaming in packet lossy networks,” *Image and Video Lab Group Meeting*, Northwestern University, Sept. 2003.
- “Optimal resource allocation in video communication systems,” *ECE Advisory Board Poster Session*, Northwestern University, May 2003.
- “Motion-compensated wavelet video coding using adaptive mode selection,” *Image and Video Lab Group Meeting*, Northwestern University, May 2001.
- “Motion-compensated video compression using wavelet transform,” *Image and Video Lab Group Meeting*, Northwestern University, Feb. 2001.

Honors

- 1998-99: Walter P. Murphy Fellowship, Northwestern University, Evanston, IL
- 10/1997: Excellent Graduate Student Scholarship, NJU
- 09/1997: The Best Paper Award, National Piezoelectric Crystal Tech. Conf., Beijing, P.R.China
- 05/1996: First Class Best Thesis Award, "5.20" Student Academic Conference, Dept ESE, NJU
- 11/1995: First Class Guang Hua Scholarship (Rank Top 2%), NJU
- 1992-95: First Class People's Scholarship (Rank Top 5%), NJU, Three times

Technical Skills

- *Programming languages(Proficient)*: C/C++, Fortran 77
- *Programming languages(Familiar)*: Visual Basic, Java, Perl, Tcl/Tk
- *Software and tools*: MATLAB, Maple, Mathematics, Network simulator 2 (ns2)
- *Operating environments*: UNIX, LINUX, MS Windows98/2000/NT/XP
- *Hardware-related languages and tools*: SystemC, Verilog, Modelsim, NCSIM
- *Image and video standards*: H.264/AVC, MPEG-2, MPEG-4, H.263, JPEG, JPEG2000
- *Communication protocols*: TCP, RTP, UDP, IP, IEEE 802.11, H.323

Professional Activities

- Organization Chair:
IEEE Consumer Communications and Networking Conference(CCNC), Special Session on Video over Wireless, 2006
- Technical Program Committee:
IEEE ICC, 2006, 2008
IEEE Globecom, Multimedia Communications Symposium, 2006
IEEE CCNC, 2006, 2007, 2008
IEEE ICCCN, 2007
IEEE ICME, 2007
- Reviewer:
IEEE Transactions on Image Processing
IEEE Transactions on Signal Processing
IEEE Transactions on Circuit System and Video Technology
IEEE Transactions on Multimedia
IEEE Transactions on Wireless Communications
Signal Processing: Image Communications
EURASIP Journal on Applied Signal Processing
EURASIP Journal on Wireless Communications and Networking
Journal of Electronic Imaging
Journal of Visual Communication and Image Representation
Journal of Systems and Software
Journal of Wireless Communications and Mobile Computing
Advances in Multimedia
Packet Video Workshop'05, '06
IEEE International Conference on Image Processing (ICIP'05, ICIP'06, ICIP'07)
IEEE International Conference on Multimedia and Expo (ICME'06, ICME'07)
IEEE Consumer Communications and Networking Conference (CCNC'06)
IEEE Workshop on Multimedia and Signal Processing (MMSP'05)
- Member:
IEEE (Signal Processing & Communications Societies)
IEEE Multimedia Communications Technical Committee

References

Available Upon Request