

## CV - Arif Tanju Erdem

Date of birth: 20.02.1965

### EDUCATION

- Ph.D.** Electrical Engineering, University of Rochester, Rochester, New York, USA, **1990**.  
**M.S.** Electrical Engineering, University of Rochester, Rochester, New York, USA, **1988**.  
**B.S.** Electrical Engineering, Bogazici University, Istanbul, Turkey, **1986**.  
**B.S.** Physics, Bogazici University, Istanbul, Turkey, **1986**.

### WORK EXPERIENCE

**Momentum A.S.**, Istanbul, Turkey, **1998-present**.  
Partner and Chief Technology Officer

**Eastman Kodak Company**, Rochester, New York, USA, **1990-1998**.

Research Scientist (1990-1992), Senior Research Scientist (1993-1996), Research Associate (1997-1998).

Member of *Digital Video Processing and Compression* Group, Electronic Imaging Research Laboratories.

- Project Leader for digital visual effects algorithm development for *Cineon* and *CineSite*.
- Team Leader for 10-bit MPEG-2 video coding algorithm development.
- Program Coordinator for university research relationships in the area of video and motion processing.

### Research Experience:

- Three-dimensional motion and shape estimation
- Three-dimensional human face modeling and animation.
- Game and logic engine development and real-time rendering.
- Video compression including MPEG-2 and MPEG-4 standards.
- Motion and texture tracking and augmented reality for visual effects.
- Image stabilization for correcting the unsteadiness in telecine film and digital video.
- Image restoration and reconstruction for removing blur and noise from video.
- Frame-rate conversion and high-resolution image reconstruction from video.

### Patents Awarded:

1. *Method for tracking motion of a face*, United States Patent 7127081, issued 24 October 2006.
2. *Method for animating a 3-D model of a face*, United States Patent 6731287, issued 4 May 2004.
3. *Method for generating a personalized 3-D face model*, United States Patent 6664956, issued 16 December 2003.
4. *Method and apparatus for encoding high-fidelity still images in MPEG bitstreams*, United States Patent 5987179, issued 16 November 1999 (with Riek and Rabbani).
5. *Method for region tracking in an image sequence using a two-dimensional mesh*, United States Patent 5982909, issued 9 November 1999 (with Toklu).
6. *Method for object tracking and mosaicing in an image sequence using a two-dimensional mesh*, United States Patent 5907626, issued 25 May 1999 (with Toklu and Tekalp).
7. *Method for multiframe Wiener restoration of noisy and blurred image sequences*, United States Patent 5550935, issued 27 August 1996 (with Ozkan and Sezan).

## ACADEMIC EXPERIENCE

### **Adjunct Faculty, Bahçeşehir University, İstanbul, Turkey, 2007-present.**

- Research Topics: Video processing, computer graphics, digital TV applications.

### **Visiting Faculty, Bilkent University, Ankara, Turkey, 1996.**

- Courses taught: Video Processing, Digital Communications, and Linear Algebra.
- Academic Advising: Supervised an M.S. student and mentored a Ph.D. student.
- Research Topics: Image stabilization, three-dimensional motion and structure estimation, and medical imaging.

### **Adjunct Faculty, University of Rochester, Rochester, New York, USA, 1990-1994.**

- Courses taught: Image Compression, Probability, Random Processes, and Estimation Theory.
- Academic Advising: Supervised a Ph.D. student and mentored several Ph.D. students.
- Research Topics: Two-dimensional region and boundary tracking, mesh-based video object representation and manipulation, and digital visual effects authoring.

## PROFESSIONAL ACTIVITIES

### **Committee Member, Moving Pictures Expert Group - MPEG, 1992-1998.**

Participated in the development of the MPEG-2 and MPEG-4 standard algorithms for video compression, HDTV, and internet applications.

### **Chairman, MPEG-2 Ad-hoc Group on 10-bit Video, 1993.**

Developed and demonstrated possible extensions of MPEG-2 to 10-bit video.

### **President, IEEE Signal Processing Society Rochester Chapter, 1992-1994.**

Organized a series of seminars in Rochester in the area of image processing by international experts in the field.

**Reviewer**, international journals and conferences on image and video processing, 1990-.

## HONORS, AWARDS, AND MEMBERSHIPS

**Member, Institute of Electrical and Electronics Engineers – IEEE, 1988-2000.**

**High-Honor Graduate, Bogazici University, 1986.**

**Fellowship, Turkish Scientific and Technical Research Institute - TUBITAK, 1981-1986.**

**First Prize, TUBITAK Marmara Region Physics Competition, 1981.**

**Third Prize, TUBITAK Marmara Region Chemistry Competition, 1981.**

## JOURNAL PUBLICATIONS

1. *An audio-driven dancing avatar*, Journal on Multimodal User Interfaces, vol. 2, no. 2, pp. 93-103, September 2008 (with Ofli, Demir, Yemez, Erzin, Tekalp, Balci, Kizoglu, Akarun, Canton-Ferrer, Tilmanne, and Bozkurt).
2. *Music Driven Real-time 3D Concert Simulation*, Lecture Notes in Computer Science, vol.4105, pp. 379-386, 2006 (with Yilmaz, Cetin, Eroglu-Erdem, and Ozkan).
3. *A new method for 3D face model generation for personalized game characters*, Journal of Intelligent Games & Simulation, vol.3, no.1, pp. 20-28, March 2004.
4. *An Illumination Invariant Algorithm for Subpixel Accuracy Image Stabilization and its Effect on MPEG-2 Video Compression*, Signal Processing: Image Communication, vol. 16, No. 9, pp. 837 - 857, June 2001 (with Eroglu).
5. *Tracking visible boundary of objects using occlusion adaptive motion snake*, IEEE Trans. Image Processing, December 2000 (with Fu and Tekalp).
6. *Semi-automatic alpha-plane generation by occlusion-adaptive mesh tracking*, IEEE Trans. Circuits and Systems for Video Tech., June 2000 (with Toklu and Tekalp).
7. *2-D mesh-based mosaic representation for manipulation of video objects with occlusion*, IEEE Trans. Image Processing, September 2000 (with Toklu and Tekalp).
8. *Tracking motion and intensity variations using hierarchical 2-D mesh modeling for synthetic object transfiguration*, Graphical Models and Image Processing, November 1996 (with Toklu, Sezan, and Tekalp).
9. *Tekalp-Erdem estimator gives the least-squares estimate of the Fourier phase and log-Fourier modulus*, IEEE Trans. Signal Processing, April 1996 (with Roux, Sole, and Tekalp).
10. *Compression of 10-bit video using the tools of MPEG-2*, Signal Processing: Image Communication, March 1995 (with Sezan).
11. *Efficient multi-frame Wiener restoration of blurred and noisy image sequences*, IEEE Trans. Image Processing, October 1992 (with Ozkan, Sezan, and Tekalp).
12. *Linear bispectrum of signals and identification of non-minimum phase FIR systems driven by colored input*, IEEE Trans. Signal Processing, June 1992 (with Tekalp).
13. *Modeling arbitrary polynomial bispectra in one- and two-dimensions*, IEEE Trans. Signal Processing, April 1992 (with Tekalp and Chang).
14. *Blur identification using the bispectrum*, IEEE Trans. Acoust., Speech, and Signal Processing, October 1991 (with Chang and Tekalp).
15. *On the measure of the set of factorizable polynomial bispectra*, IEEE Trans. Acoust., Speech, and Signal Processing, September 1990 (with Tekalp).
16. *Higher-order spectrum factorization in one- and two-dimensions with applications in signal modeling and nonminimum phase system identification*, IEEE Trans. Acoust., Speech., and Signal Processing, October 1989 (with Tekalp).

## BOOK CHAPTERS

1. *Object tracking using hierarchical 2-D mesh modeling for content based video compression*, in Video Data Compression for Multimedia Computing, edited by Li, Sun, and Derin, Kluwer Academic, 1996 (with Toklu, Sezan, and Tekalp).
2. *Multi-frame Wiener restoration of image sequences*, in Motion Analysis and Image Sequence Processing, edited by Sezan and Lagendijk, Kluwer Academic, 1993 (with Ozkan, Sezan, and Tekalp).

## CONFERENCE PUBLICATIONS

1. *Unsupervised Dance Figure Analysis from Video for Dancing Avatar Animation*, IEEE International Conference on Image Processing, ICIP, October 12-15, San Diego, California, USA, 2008 (with Ofli, Erzin, Yemez, Tekalp, Eroglu-Erdem, Abaci, and Ozkan).
2. *Speech-Driven Automatic Facial Expression Synthesis*, 3DTV Conference, İstanbul, May 2008 (with Bozkurt, Eroglu-Erdem, Erzin, Ozkan, and Tekalp).
3. *Combined Filtering and Keyframe Reduction for Motion Capture Data*, 3DTV Conference, İstanbul, May 2008 (with Onder, Gudukbay, Ozguc, Eroglu-Erdem, and Ozkan).
4. *Prosody-Driven Head Gesture Animation*, Int. Conf. Acoustics, Speech, Signal Processing, ICASSP, Honolulu, Hawaii, USA, April 15-20, 2007 (with Sargin, Erzin, Yemez, Tekalp, Eroglu-Erdem, and Ozkan)
5. *Mid-air Display for Physical Exercise and Gaming*, 3DTV Conference, Kos, Greece, May 2007 (with Rakkolainen, Eroglu-Erdem, Utku, and Ozkan).
6. *Comparison of Phoneme and Viseme based Acoustic Units for Speech Driven Realistic Lip Animation*, 3DTV Conference, Kos, Greece, May 2007 (with Bozkurt, Eroglu-Erdem, Erzin, and Ozkan)
7. *Interactive 'Immaterial' Screen for Performing Arts*, ACM Multimedia 2006, Interactive Arts Program (short paper), pp. 185-188, Santa Barbara, CA, USA, October 23-27, 2006 (with Rakkolainen, Eroglu-Erdem, Ozkan, and Laitinen).
8. *Combined Filtering and Key-frame Reduction of Motion Capture Data with Application to 3DTV*, WSCG'06: Int. Conf. Computer Graphics, Visualization and Computer Vision, Czech Republic, Jan.30 – Feb.3, 2006 (with Onder, Eroglu-Erdem, Gudukbay, and Ozguc)
9. *A new method for generating 3-D face models for personalized user interaction* European Signal Processing Conference (EUSIPCO), September 2005, Antalya, Turkey.
10. *Key-frame based video object representation and manipulation*, IEEE Int. Conf. Image Processing, January 1998 (with Eren and Tekalp).
11. *Occlusion-adaptive motion snake*, IEEE Int. Conf. Image Processing, January 1998 (with Fu and Tekalp).
12. *The effect of image stabilization on the performance of the MPEG-2 video coding algorithm*, SPIE Int. Conf. Visual Comm. Image Processing, San Jose, USA, January 1998 (with Eroglu).
13. *A fast algorithm for subpixel accuracy image stabilization for digital film and video*, SPIE Int. Conf. Visual Comm. Image Processing, San Jose, USA, January 1998 (with Eroglu).
14. *Two-D mesh-based synthetic transfiguration of an object with occlusion*, IEEE Int. Conf. Acoust., Speech, Signal Processing, Munich, Germany, April 1997 (with Toklu and Tekalp).
15. *Three-D motion and dense structure estimation using convex projections*, SPIE Int. Conf. Visual Comm. Image Processing, San Jose, USA, February 1997 (with Alatan and Onural).
16. *Two-D triangular mesh-based mosaicing for object tracking in the presence of occlusion*, SPIE Int. Conf. Visual Comm. Image Processing, San Jose, USA, February 1997 (with Toklu and Tekalp).
17. *Two-D mesh-based tracking of deformable objects with occlusion*, IEEE Int. Conf. Image Processing, September 1996 (with Toklu, Sezan, and Tekalp).
18. *Tracking motion and intensity variations for synthetic object transfiguration using hierarchical 2-D mesh modeling*, IEEE Int. Conf. Image Processing, September 1995 (with Toklu, Sezan, and Tekalp).
19. *Multi-generation characteristics of the MPEG video compression standards*, IEEE Int. Conf. Image Processing, Austin, USA, November 1994 (with Sezan).
20. *Evaluation of 3-D motion and structure estimation algorithms for model-based video compression*, IS&T Int. Conf. Physics Chemistry Imaging Systems, May 1994, Rochester, USA, May 1994 (with Altunbasak, Tekalp, and Sezan).

21. *Scalable extension of MPEG-2 for coding 10-bit video*, SPIE Int. Conf. Visual Comm. Image Processing, San Jose, USA, February 1994 (with Sezan).
22. *A nonredundant set for the bispectrum of 2-D signals*, IEEE Int. Conf. Acoust., Speech, Signal Processing, Minneapolis, USA, April 1993.
23. *A set-theoretic phase unwrapping technique for least-squares image reconstruction from the higher-order spectrum*, IEEE Int. Conf. Acoust., Speech, Signal Processing, Minneapolis, USA, April 1993 (with Sezan).
24. *A hierarchical phase correlation method for motion estimation*, Conf. Information Sciences Systems, pp. 419-424, Baltimore, USA, March 1993 (with Erkam and Sezan).
25. *Least-squares reconstruction of an image from its noisy observations using the bispectrum*, SP Workshop Statistical Signal Array Processing, October 1992 (with Sezan).
26. *Iterative least-squares reconstruction of the Fourier phase of an image from the modulo 2-pi phase of its bispectrum*, SPIE Int. Conf. Visual Comm. Image Processing, San Diego, USA, July 1992 (with Sezan).
27. *Motion-Compensated Multiframe Wiener Restoration of Blurred and Noisy Image Sequences*, IEEE International Conf. Acoust., Speech and Signal Processing, March 1992, San Francisco, USA (with Ozkan and Sezan).
28. *LMMSE Restoration of Blurred and Noisy Image Sequences*, SPIE Visual Communications and Image Processing, November 1991, Boston, USA (with Ozkan, Sezan, and Tekalp).
29. *Image Sequence Restoration Using Multiframe Wiener Filtering*, IEEE Seventh Workshop on Multidimensional Signal Processing (abstract only), September 1991, Lake Placid, USA (with Ozkan, Sezan, and Tekalp).
30. *New Theoretical Results on the Bistatistics of 2-D Signals*, Int. Signal Proc. Workshop on Higher-Order Statistics, July 1991, Chamrousse, France (with Tekalp).
31. *Matching Extrapolation of Bicomulants of One-D Signals Using Two-D AR Modeling*, IEEE Int. Conf. Acoust., Speech and Signal Proc., May 1991, Toronto, Canada (with Tekalp).
32. *A Composite Signal Model That Simultaneously Realizes Arbitrary Polynomial Bispectra and Rational Power Spectra*, IEEE Int. Conf. Acoust., Speech and Signal Proc., May 1991, Toronto, Canada (with Tekalp and Chang).
33. *On Modeling the Focus Blur in Image Restoration*, IEEE Int. Conf. Acoust., Speech and Signal Proc., May 1991, Toronto, Canada (with Sezan, Pavlovic, and Tekalp).
34. *Modeling Arbitrary Polynomial Bispectra Using Systems with Multiplicity in One- and Two-Dimensions*, Fifth ASSP Workshop on Spectrum Estimation and Modeling, October 1990, Rochester, USA (with Tekalp).
35. *Blur Identification Based on Bispectrum*, European Signal Proc. Conf., September 1990, Barcelona, Spain (with Tekalp).
36. *Blur Identification Using Bispectrum*, IEEE Int. Conf. Acoust., Speech and Signal Proc., April 1990, Albuquerque, USA (with Tekalp).
37. *Image Modeling Using Higher-Order Statistics with Application to Predictive Image Coding*, IEEE Int. Conf. Acoust., Speech and Signal Proc., April 1990, Albuquerque, USA (with Tekalp and Ozkan).
38. *Two-dimensional Higher-Order Spectrum Factorization with Application in NonGaussian Image Modeling*, IEEE Workshop on Higher-Order Spectral Analysis, June 1989, Vail, USA (with Tekalp).
39. *Higher-Order Spectrum Factorization with Applications*, IEEE Int. Conf. Acoust., Speech and Signal Proc., May 1989, Glasgow, Scotland (with Tekalp).
40. *Decision-Directed Adaptive Image Restoration Using Multiple Image and Blur Models*, Int. Conf. Control, April 1989, Jerusalem, Israel (with Tekalp).
41. *Image-Blur Identification by Moving-Average Model Order Estimation*, European Signal Processing Conf., September 1988, Grenoble, France (with Tekalp).