

Irfan Aziz Essa

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Main Research Interests

Interested in studying systems and environments that include people. Developing methods for automatic extraction of information from video. Primarily interested in defining models and extracting procedural representations for analysis, interpretation, coding, tracking and resynthesis of spatio-temporal events from various input sources and using them to develop smart and reactive environments.

Research Areas

Media technology, computer vision, computer graphics, human-machine interaction, computer aided design, biomedical visualization, large modular systems, robotics, cognitive sciences, image processing, and control theory.

Education

Ph. D., MASSACHUSETTS INSTITUTE OF TECHNOLOGY *September 1994*
Thesis Title: "Analysis, Interpretation, and Synthesis of Facial Expressions."
Thesis Supervisor: Professor Alex Pentland, MIT Media Laboratory.
Thesis Committee: Professor Norman Badler, University of Pennsylvania, and Professor Alan Yuille, Harvard University.

S. M. Engineering, MASSACHUSETTS INSTITUTE OF TECHNOLOGY *June 1990*
Thesis Title: "Contact Detection, Collision Response and Friction for Physically-based Virtual World Modeling and Vision Systems."
Thesis Supervisors: Professor Alex Pentland, MIT Media Lab, and Professor John Williams, Intelligent Engineering Systems Lab.

B. S. Engineering, ILLINOIS INSTITUTE OF TECHNOLOGY *May 1988*
Graduated with high honors, on the Dean's high honors list all semesters. Specialized in Civil, Structural Engineering and Dynamics.

Experience

Research Experience

MIT MEDIA LABORATORY **CAMBRIDGE, MA.**
1994--Present Research Scientist, Perceptual Computing Section/Vision and Modeling Group
Involved in research in the fields of multi-media technologies, computer vision, graphics, and robotics with a focus on measuring and modeling human movements for vision-based wireless interfaces, human-machine interaction, tele-cooperation, "Things That Think", "Looking at People", "Smart & Reactive Rooms/Environments", and "Affective Computing", concepts. Assisting in the day to day research operations of the Vision and Modeling Group comprising of 3 faculty members, and over 20 graduate and 15 undergraduate student researchers. Serving several administrative functions on both group, lab and institute wide basis.

1988--1994 Research Assistant, Perceptual Computing Section/Vision and Modeling Group
Research and development of algorithms for physically-based models and applications to computer vision, graphics, and robotics with a focus on modeling and representations for vision-based wireless interfaces for human-machine interaction.

summer 1990 **THINKING MACHINES CORPORATION** **CAMBRIDGE, MA.**
 Researcher/Summer Intern, Vision Group

Teaching Experience

MASSACHUSETTS INSTITUTE OF TECHNOLOGY **CAMBRIDGE, MA.**
 Spring 1995 Machine Understanding of Video (MAS 961) with A. Pentland, R. Picard and J. Cassell.
 Fall 1994 Reading Seminars on Machine Perception and Modeling Human Movements with A. Pentland.

ILLINOIS INSTITUTE OF TECHNOLOGY **CHICAGO, IL.**
 1987-1988 Instructor / Teaching Assistant, Introduction to Computers (CS 100) with J. Mohammedi.
 1986-1988 Head Tutor / Tutor in Math, Physics, CS, Engineering at the Educational Technology Center.

Professional Activities

- Program Co-chair, Workshop on Nonrigid and Articulated Motion, In Conjunction with CVPR97, St. Thomas, Virgin Islands, June 1997 (Proposed).
- Program Chair, Second International Conference on Automatic Face and Gesture Recognition '96, Woodstock, VT., USA, October 1996.
- Member, Program Committee, International Conference on Multi-Modal Interface '96, Beijing, China, April 1996.
- Panel Member, NSF Workshop on Facial Modeling and Animations, Philadelphia, PA., USA, November, 1993.
- Reviewer, International Conference on Computer Vision (ICCV 1993, 1995).
- Reviewer, Computer Vision and Pattern Recognition (CVPR 1992, 1993, 1994, ISCV 95).
- Reviewer, IEEE Trans. PAMI, IJCV, PRESENCE, DISPLAYS and several other Academic Journals
- Junior Reviewer, SIGGRAPH '93, '94, '95.
- Junior Reviewer, several symposia and workshops organized by IEEE, ACM and NSF.
- Member, ACM (SIGGRAPH, SIGCHI).
- Member, IEEE (Computer Society, Multimedia, PAMI-TC).

Awards & Honors

- Outstanding Student of the Year Award (1988), awarded by the ASCE, Illinois Section.
- Outstanding Student Award (1988), awarded by the IIT Alumni Association.
- Stryker Distinguished Service Award (1988), awarded by the Dean of Student Life, IIT.
- Honor Marshall (1987, 88), appointed by the Dean of Student Life, IIT.
- Invited Member, Sigma Xi (1990), Tau Beta Pi (1987), and Chi Epsilon (1987).

Other Experience

- Alchemy Inc., Palo Alto, CA., USA, (1995--Present), Advisor/Consultant on Concept, Business Plan.
- Scientific Advisor on several other Business Plans (1994--Present).
- Guild Inc., Cambridge, MA., USA, (1994), Consultant.
- Midway Airport Hotel Partnership, Chicago, IL., USA, (1990--Present), Partner.
- Several other consulting positions (1990--1995).
- Cooperative Engineers Limited, Karachi, Pakistan, (1987--88), Summer Intern.

Other Activities

- Student Representative, Media Lab Super Faculty Committee, MIT (1992).
- President and Vice President of the Illinois Beta chapter of Tau Beta Pi (1986--88).
- President and Treasurer of the Illinois Tech chapter of Chi Epsilon (1986--88).
- Founding member of the IIT President's Student Leadership Committee (1987--88).
- Founder & Chairperson, Excellence in Teaching Awards Committee, IIT(1987--88).

Publications**Refereed Journal****Publications**

I. Essa. and A. Pentland. "Coding, Analysis, Interpretation and Recognition of Facial Expressions." In Review, *IEEE Transactions on Pattern Analysis and Machine Intelligence*.

T. Darrell, I. Essa, and A. Pentland. "Task-specific Gesture Modeling using Interpolated Views." In Print, *IEEE Transactions on Pattern Analysis and Machine Intelligence*.

I. Essa, S. Sclaroff, and A. Pentland. "A Unified Approach for Physical and Geometric Modeling for Graphics and Animation." In *Computer Graphics Forum, The International Journal of the Eurographics Assoc.*, Vol. II (3), Cambridge, England, September 1992.

A. Pentland, I. Essa, M. Friedmann, B. Horowitz, and S. Sclaroff. "The ThingWorld Modeling System: Virtual Sculpting by Modal Forces." In *ACM Computer Graphics*, pp. 143-144, March 1990.

Refereed Conference & Workshop**Proceedings**

I. Essa and S. Basu. "Modeling, Tracking and Interactive Animation of Facial Expressions and Head Movements using Input from Video.", Appears, *Proceedings of Computer Animation 1996 Conference*, Geneva, Switzerland, June 1996.

S. Basu and I. Essa. "Motion Regularization for Model-based Head Tracking.", Appears, *Proceedings of International Conference on Pattern Recognition*, Vienna, Austria, August 1996.

I. Essa and A. Pentland. "Facial Expression Recognition using a Dynamic Model and Motion Energy.", In, *Proceedings of the International Conference on Computer Vision 1995*, Cambridge, MA., May 1995.

I. Essa and A. Pentland. "Facial Expression Recognition using Visually Extracted Facial Action Parameters.", In, *Proceedings of the International Workshop on Automatic Face and Gesture Recognition*, Zurich, Switzerland, June 1995.

I. Essa, T. Darrell, and A. Pentland. "Tracking Facial Motion.", In *Proceedings of IEEE Nonrigid and Articulated Motion Workshop 1994*, Austin, TX., November 1994.

I. Essa and A. Pentland. "A Vision System for Observing and Extracting Facial Action Parameters", In *Proceedings of IEEE Computer Vision Pattern Recognition Conference 1994*, Seattle, WA., June 1994 .

M. Brand and I. Essa. "Causal Analysis for Visual Gesture Understanding.", at *AAAI Fall Symposium on Computational Models for Integrating Language and Vision* Cambridge, MA., November 1995.

T. Darrell, I. Essa, and A. Pentland. "Correlation and Interpolation Networks for Real-time Expression Analysis/Synthesis.", In G. Tesauro, D. S. Touretzky, and T. K. Leen (Editors), *Advances in Neural Information Processing Systems (NIPS) 7*, Denver, CO., MIT Press 1995.

A. Pentland, I. Essa, T. Darrell, and S. Sclaroff. "Visually Guided Animation.", In *Proceedings of Computer Animation 1994 Conference*, Geneva, Switzerland, May 1994.

S. Sclaroff, I. Essa, and A. Pentland. "Vision-based Modeling: An Application of a Unified Approach for Physical and Geometric Modeling for Graphics and Animation." at *Workshop on Animations and Simulations Eurographics '92*, Cambridge, England, September 1992.

Book Chapters

I. Essa, "Motion and Model based Recognition and Interpretation of Facial Expressions." Appears in *Motion Based Recognition*, M. Shah and R. Jain (Editors), Kluwer Academic Publishers, Computational Imaging and Vision Series, 1996.

I. Essa, S. Sclaroff, and A. Pentland. "Physically-based Modeling for Graphics and Vision." Chapter in *Directions in Geometric Computing*, R. Martin (Editor), Information-Geometers, UK., 1993.

A. Pentland, S. Sclaroff, B. Horowitz, and I. Essa. "Modal Descriptions for Modeling, Recognition and Tracking." In *Three-Dimensional Object Recognition Systems*, Vol. I, A K. Jain and P. J. Flynn (Editors), Elsevier Science Publishers, 1993.

Video

I. Essa, T. Darrell, and A. Pentland. "Modeling and Tracking Facial Expression.", in *Standards of Facial Expressions*, SIGGRAPH Video Review 1995.

Invited Presentations

"Perceiving and Understanding Human Actions for Interactive Video Environments", at *Electrotechnical Laboratory*, Ibaraki, Japan, March 1996.

"Perception and Modeling of Human Activity ", at *ATR Research Labs.*, Kyoto, Japan, March 1996.

"Looking at People: Extracting Human Movements.", at *International Workshop on Computer Vision and Parallel Processing 1995*, Islamabad, Pakistan, January 1995.

"Non-invasive Motion Analysis.", at *International Symposium on Human Movement Analysis*, Stockholm, Sweden, July 1994.

"Visual Interpretation of Facial Expressions.", at *NSF Workshop on Facial Animations* Philadelphia, PA., November 1993.

"Physically-based Modeling for Vision, Graphics and Control.", at *Academy of Media Arts*, Cologne, Germany, September 1992.

"Visualization using Vision-based Modeling." at *GMD Super computing Facility*, Visualization Group, Bonn, Germany, September 1992.

"Nonrigid and Rigid Dynamic Modeling for Animation & Graphics.", at *Ecole Normale Superieure*, Department de Mathematiques et Informatique, Paris, France, September 1992.

Presentations & Demonstrations

A. Pentland, I. Essa, T. Darrell, A. Azarbayejani and S. Sclaroff. "Visually Guided Interaction and Animation" *Twenty-eighth Asilomar Conference on Signals, Systems & Computers '94*, Asilomar, CA., November 1994.

M. Friedmann, I. Essa, B. Horowitz, S. Sclaroff, T. Starner, and A. Pentland. "Distributed ThingWorld" Live Demonstration of the system at *G-Tech*, ACM SIGGRAPH Conference, '92, Chicago, IL., August 1992.

A. Pentland, I. Essa, M. Friedmann, B. Horowitz, S. Sclaroff and T. Starner. "ThingWorld" Live Demonstration of the system at *ACM Computer Graphics, Second Interactive 3D Graphics Symposium*, Snowbird, UT., March 1990.

Additional Info.
Graduate Supervision

- Sumit Basu MEng. Thesis Reader (1995--Present).
- Ken Miller MEng. Thesis Supervisor (1995--Present).

Undergraduate Supervision

- Thad Starner
- Erik Trimble
- Cyrus Ester
- Aaron Thomason
- Nathan Williams
- Alex Kuperman

Personal

Permanent Resident of US, Applied for Naturalization to US (Dec '95).
 Born in Karachi Pakistan (Dec 11, 1965).

Interests include teaching, photography, traveling, squash, computers & gadgets, outdoor sports and activities, and group activities.

References

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(Additional References made available on request.)
