Shumeet Baluja, Ph.D.

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Curriculum Vitae
June, 2008

Employment (Current)

Google, Inc.
Senior Staff Research Scientist, 2003-Current
*(only published or public **research** accomplishments described here)*

Wireless / Mobile Computing: Started Google's wireless practice and incubated initial team within Google (2003). Created first Google prototypes of handset resident capabilities. Hand-picked and recruited initial engineers and leadership team. Led or participated in initial partnership, acquisition and deal negotiations and sourcing. Provided technology/strategy leadership while assembling team. Numerous patents and publications on original wireless research. [See 5,30,34,40,38]

Social-{Graphs, Recommendations, Advertising}: Inferring, understanding, and propagating information and preferences efficiently within the context of multi-million node and multi-billion edge social, and *inferred*-social, networks. [See 27]

Video and Audio-Copyright: DRM technology for copyright infringement: research and prototypes of core matching algorithms. Related research in combining large-scale hashing and data-stream algorithms on sparse sketches of audio, image and video data resulted in numerous patents and publications on research and system [See 8,29,31,32].

Image & Vision Computing: Large scale image processing applications. Face processing (detection, attribute recognition), fast indexing, near/duplicate lookup. Page-rank for images (VisualRank). [See 7, 1, 28, 35, New York Times, Google-Research-Blog].

National Center for Missing and Exploited Children (NCMEC): Initiated a large project to donate to NCMEC state-of-the-art Google research code to help manage inflow of illegal/abuse images. I worked with NCMEC and led our research team to ensure that what we gave them would be both cutting edge and usable. It is currently being used at NCMEC (in Washington DC) to maintain and categorize known instances of illegal, abuse, images. See [CBS, BBC, Reuters, USA Today, Google Official Blog]

Other:

- Extensive press and media coverage for research and projects conducted (1000's of newspapers and on-line news and blog sites).
- Extensive patents and IP created.
- Created and held lectures on "Introduction to Technical Due-Diligence" for corporate acquisitions (based on an earlier lecture I developed at eCompanies).
- Supervised and mentored junior and senior members of research teams. Supervised first Ph.D. Thesis to be proposed and completed while at Google on Google research (Maryam Kamvar, Columbia University).

Employment (Previous)

Jamdat Mobile, Inc.
Chief Technology Officer, 2000(inception)-2002
IPO: September 29, 2004.
Electronic Arts Acquisition of Jamdat Announced December, 2005.

Execution: Created the most successful games and entertainment applications on the wireless internet. Responsible for all engineering and technology initiation, design, implementation and maintenance. Oversaw application development across all mobile platforms: WAP, BREW, J2ME. Spearheaded the initiation, design, and implementation of

back-end services including comprehensive wireless datamining, billing integration, and detailed usage tracking.

Strategy: Completed an oversubscribed Series-B Round funding with CEO (closed 3/2001) from Patricof and Co. Ventures, Sun Microsystems, Qualcomm & Intel. Started raising C-Round. Continually worked to set direction of company and market positioning with CEO and CFO. Work closely with sales and strategy to proliferate Jamdat's services with carriers and partners.

eCompanies, LLC

Senior Vice President, Research & Development, 2000

Execution: Built the technical team for 4 of the 12 companies incubated. Once a company entered the incubator, responsibilities included ensuring that each of the companies had a strong technological foundation (making and monitoring technical decisions until team was hired), and building a strong technology team to support the company.

Strategy: Responsible for due-diligence of new business plans as well as mining industry and academic sources to discover potential incubatee companies. Researched and analyzed market and technology to determine the feasibility of incubating ASP infrastructure companies, datamining companies, and wireless companies. Spearheaded the wireless practice at eCompanies, which resulted in the creation of *eCompanies Wireless,* a joint venture between eCompanies and Sprint PCS.

Lycos, Inc.

Chief Scientist, 1998-2000.

Execution: Created the Lycos Research and Applied Technology group. Recruited the team, managed up to 40 people. Managed budget and organization. Deployed numerous services at Lycos:

- Ad targeting for user home pages
- Web-Log Datamining.
- Web Trend Analysis and Profiling
- User interaction studies and measurements for search and site navigation.
- Automatic Document Categorization for classification into web directories.
- Kid-Safe Search for Lycos.
- Voice Mail and Voice-Based Products.
- Information/Document Retrieval Eval Metrics and Algorithmic improvement.

Strategy: Responsible for setting research directions, transfer of research to products, academic collaborations, and 'advanced' technical recruiting. Responsible for the technical due diligence of new companies for integration into Lycos.com

Justsystem Pittsburgh Research Center (JPRC).

Research Coordinator, 1997-1998. *Research Scientist*, 1996 - 1997.

Helped to determine direction of machine learning and computer vision research at JPRC. Research on combining machine learning and statistics for applications in computer vision, mixed media databases, and automatic document classification. Research also included probabilistic modeling for optimization in high-dimensional combinatorial search spaces.

Department of Computer Science - Carnegie Mellon University.

Adjunct Research Scientist, 1996 - 2002.

Worked with students and faculty on combinatorial and real-valued optimization for high-dimensional search spaces. Also collaborated on projects for vision-based human-computer user interfaces.

The Robotics Institute - Carnegie Mellon University.

Adjunct Research Scientist, 1996 - 2005.

Worked with students and faculty towards integration of learning and computer vision for object detection, with applications to automatic video-indexing.

Education

Ph.D. 1996, Computer Science
School of Computer Science, Carnegie Mellon University.
Dissertation: *Expectation-Based Selective Attention*.
Primary Advisor: Dr. Dean Pomerleau; Secondary Advisor: Dr. Tom Mitchell.

B.S. Honors, High Distinction, 1991
School of Engineering and Applied Science, University of Virginia.
CS Minor: Philosophy/Cognitive Studies.
Thesis Advisor: Dr. Dana Richards, National Science Foundation.

Research Fellowship
Oak Ridge National Laboratories.
Advisor: Dr. Gunar Liepins, Studies in High Dimensional Optimization.

Professional Activities & Students

Numerous invited talks in academics and industry.

Board Member of various startups.
Technical Advisory Board, DirectHit.com (acquired by AskJeeves.com)
Editorial Board Member - Applied Intelligence Journal – 2007.

Ph.D. Advisor (joint with Steve Feiner). Maryam Kamvar, Columbia University, Graduated, 2008. Thesis: Using Context to Improve Query Formulation and Entry from Mobile Phones

Member of Thesis Examination Committee for Marcus Gallagher, University ofQueensland, Australia. Thesis “Multilayer Perceptron Error Surfaces: Visualization, Structure and Modeling”. Advisor Dr. Tom Downs.

Member of Ph.D. Thesis Advisory Committee for Michael C. Nechyba, The Robotics Institute, Carnegie Mellon University. Thesis: “Learning and Validation of Human Control Strategies.”

Member of Ph.D. Thesis Advisory Committee for Henry Rowley, Computer Science, Carnegie Mellon University. Thesis: “A Trainable Object Detection System.”

Member of Thesis Advisory Committee for Adena Zlochower, Clinical Psychology, University of Pittsburgh. On the comparison of Computer Vision, EMG, and FACS for emotion recognition.

Reviewed Journal Submissions For:
ACM Transactions on Computer Systems, IEEE Transactions on Pattern Recognition and Machine Intelligence Artificial Intelligence Journal, Evolutionary Computation Journal, IEEE Intelligent Systems, IEEE Knowledge & Data Engineering, IEEE Transactions on Evolutionary Computation, IEEE Transactions on Image Processing, IEEE Transactions on Systems, Man and Cybernetics, IEEE Robotics and Automation Journal, Image and Vision Computing Journal, International Journal of Artificial Neural Networks, International Journal for Artificial Intelligence in Engineering, International Journal of Applied Intelligence, International Journal of Computer Vision, Journal of Artificial Intelligence Research (JAIR), Journal of Intelligent and Fuzzy Systems, Machine Learning

Program Committee Member and/or reviewer for numerous conferences in Web, Machine Learning, AI, Robotics, Pattern Recognition, etc.

Patents

Granted
Method for rule-based correction of spelling and grammar errors
Method for finding all frontal faces in arbitrarily complex visual scenes
Assessing wireless network quality

Disclosed: (20+ public, numerous not shown here)
(click here for currently public ones)
20080005668 User interface for mobile devices
20070239529 Targeting and/or scoring advertisements using information derived from called telephone numbers or the called telephone numbers themselves
20070234283 Automatic code generation for applications which run on common platforms
20070233487 Automatic language model update
20070143778 Determining Popularity Ratings Using Social and Interactive Applications for Mass Media
20070130580 Social and Interactive Applications for Mass Media
20070124756 Detecting Repeating Content in Broadcast Media
20070072676 Using information from user-video game interactions to target advertisements, such as advertisements to be served in video games
20070067329 Overloaded communication session
20070066364 Customized data retrieval applications for mobile devices providing interpretation of markup language data
20070022442 Dispatch system to remote devices
20060287913 Allocating advertising space in a network of displays
20060235933 Method and system for activity based email sorting
20060230350 Nonstandard locality-based text entry
20060149624 Generating and/or serving local area advertisements, such as advertisements for devices with call functionality
20060149622 Ad rendering parameters, such as size, style, and/or layout, of online ads
20060149461 Transportation routing
20060122976 Predictive information retrieval
20060005113 Enhanced document browsing with automatically generated links based on user information and context
20060004627 Advertisements for devices with call functionality, such as mobile phones
20050289141 Nonstandard text entry
20030149958 Automatic code generation for applications which run on common platforms

Journal Publications

1. Baluja, S. & Covell, M. (2008) "Learning To Hash: Forgiving Hash Functions and Applications" in *Data Mining and Knowledge Discovery* Article on Springer.
2. Baluja, S. & Covell, M. (2008), "Waveprint: Efficient Wavelet-Based Audio Fingerprinting", to appear in *Pattern Recognition*.
3. Jing, Y. & Baluja, S. (2008) "VisualRank: Applying PageRank to Large-Scale Image Search", to appear in *IEEE Pattern Analysis and Machine Intelligence (PAMI)*
4. Baluja, S. (2007) "Automated Image Orientation Detection: A Scalable Boosting Approach", *Pattern Analysis and Applications*. Article at Springer
5. Kamvar, M. & Baluja, S. (2007), Deciphering Trends in Mobile Search, *IEEE Computer*. IEEE-Computer 2007
6. Baluja, S. & Rowley, H. (2007) "Boosting Sex Identification Performance" *International Journal of Computer Vision (IJCV),* Volume 71, Number 1. 111-119. Article at Springer.
7. M. Fink, M. Covell, S. Baluja (2006) "Mass Personalization: Social and Interactive Applications using Sound-Track Identification", *Journal of Multimedia Tools and Applications, 2006.* (invited submission). Article at Springer.
8. M. Covell, S. Baluja, M. Fink (2006) "Detecting Ads in Video Streams Using Acoustic and Visual Cues", *IEEE-Computer*, December 2006. Computer-2006
9. Baluja, S. (2002) "Using a priori Knowledge to Create Probabilistic Models for Optimization", *International Journal of Approximate Reasoning*, Volume 31, Issue 3,

pp 193-220. IJAR

10. Baluja, S. Mittal, V., Sukthankar, R. (2000) “Applying machine learning for high-performance named-entity extraction”. *Computational Intelligence*, 16/4 November 2000. 586-595. (pre-press) (computational intelligence journal)
11. Baluja, S. (2000) “Using Labeled and Unlabeled Data for Probabilistic Modeling of Face Orientation”, *International Journal of Pattern Recognition and Artificial Intelligence*, Vol. 14, No. 8 (2000) 1097-1107 .(IJPRAI)
12. Contributing author to Boyan, Buntine, Jagota (ed.) (2000) “Statistical Machine Learning for Large-Scale Optimization” in *Neural Computing Surveys* 3, 2000. (at citeceer)
13. Baluja, S. & Pomerleau, D.A. (1998) “Dynamic Relevance: Vision Based Focus of Attention using Artificial Neural Networks,” *Artificial Intelligence*, Vol. 97 (1-2) pp. 381-395. (AIJ)
14. Rowley, H., Baluja, S. & Kanade, T. (1998) “Neural Network-Based Face Detection,” *IEEE-Transactions on Pattern Analysis and Machine Intelligence (PAMI),* Vol. 20, No. 1, January, 1998. IEEE-PAMI Version
15. Sukthankar, R., Baluja, S., & Hancock, J. (1998) “Multiple Adaptive Agents for Tactical Driving,” *International Journal of Applied Intelligence*, Volume 9, Issue 1, July, 1998.
16. Baluja, S. & Pomerleau, D.A. (1997) “Expectation-Based Selective Attention for the Visual Monitoring and Control of a Robot Vehicle,” *Robotics and Autonomous Systems Journal,* Vol. 22 pp. 329-344. Robotics and Autonomous Systems Journal Version
17. Baluja, S. & Simon, D. (1997) “Evolution-Based Methods for Selecting Point Data for Object Localization: Applications to Computer-Assisted Surgery,” *International Journal of Applied Intelligence,* Vol. 8, pp. 1-13. CMU-CS-96-183
18. Baluja, S. & Maxion, R. (1996) “Artificial Neural Network Based Approaches to Detection and Classification of Plasma-Etch Anomalies,” *The Journal of Intelligent Systems,* Volume 7, No. 1-2, 57-82, 1997. JIS-97
19. Baluja, S. (1996) “Evolution of an Artificial Neural Network Based Autonomous Land Vehicle Controller,” *IEEE Transactions on Systems, Man and Cybernetics,* Vol. 26 No. 3, 450-463, June 1996. (Scanned)
20. Baluja, S., Pomerleau, D.A. & Jochem T. (1994) “Towards Automated Artificial Evolution for Computer Generated Images,” *Connection Science,* Volume 6, 2 & 3. 1994. (connection science) Also appears in *Musical Networks: Parallel Distributed Perception and Performance* (eds.) N. Griffith, P.M. Todd.

Book Chapters

21. Baluja, S. (2006) “Incorporating a priori Knowledge in Probabilistic-Model Based Optimization”, in M. Pelikan, K. Sastry, E. Cantu-Paz (eds.) *Scalable Optimization via Probabilistic Modeling: From Algorithms to Applications*, 205-219, Springer (book on amazon)
22. Baluja, S., Pomerleau, D.A. & Jochem T. (1999) “Towards Automated Artificial Evolution for Computer Generated Images,” in N. Griffith & P.M. Todd (eds.), *Musical Networks: Parallel Distributed Perception and Performance*, MIT Press. (book on amazon)
23. Baluja, S., Sukthankar, R., Hancock, J. (1996) “Prototyping Intelligent Vehicle Modules Using Evolutionary Algorithms,” in Dasgupta, D. & Michalewicz, Z. (eds.) *Evolutionary Algorithms in Engineering Applications*. Springer Verlag, Berlin. 241-257.
24. Baluja, S. (1995) “Evolving Artificial Neural Networks: Learning to Steer a Land Vehicle,” *The Practical Handbook of Genetic Algorithms, Vol II.* Chambers, L. (Ed). CRC Press. Boca Raton, FL. 31-51. (book on amazon)
25. Baluja, S. (1995) “Structure and Performance of Fine Grain Parallelism in Genetic

Search," *The Practical Handbook of Genetic Algorithms, Vol. II.* (book on amazon) Chambers, L. (Ed). CRC Press. Boca Raton, FL. 139-153. Also Appears in S. Forrest ed., *Genetic Algorithms: Proceedings of the Fifth International Conference (ICGA93)*, Morgan Kaufmann Publishers, San Mateo, CA., 1993.

26. Jochem, T. & Baluja, S. (1994) "Massively Parallel, Adaptive, Color Image Processing for Autonomous Road Following," *Massively Parallel Artificial Intelligence.* Hiroaki Kitano & James Hendler (Eds.), AAAI Press. Menlo Park, CA., 1994. (TR: MPRF (DRAFT)) (book on amazon)

Conference Publications

27. S. Baluja, R. Seth, D. Sivakumar, Y. Jing, J. Yagnik, S. Kumar, D. Ravichandran, M. Aly (2008), Video Suggestion and Discovery for YouTube: Taking Random Walks Through the View Graph, *Proceedings of WWW-2008 (WWW-2008),* WWW-2008
28. Y.Jing, S. Baluja (2008) PageRank for Product Image Search, *Proceedings of WWW-2008 (WWW-2008)* WWW-2008
29. S. Baluja, M. Covell, S. Ioffe (2008), Permutation Grouping: Intelligent Hash Function Design for Audio & Image Retrieval*, International Conference on Acoustics, Speech and Signal Processing (ICASSP-2008),* ICASSP-2008
30. M. Kamvar, S. Baluja, (2008), Query Suggestions for Mobile Search: Understanding Usage Patterns, *SIGCHI-2008: Computer Human Interaction*. CHI-2008
31. S. Baluja, M. Covell (2007) Audio Fingerprinting: Combining Computer Vision and Data Stream Processing. *International Conference on Acoustics, Speech and Signal Processing (ICASSP-2007).* ICASSP-2007
32. M. Covell, S. Baluja (2007) Known-Audio Detection Using Waveprint: Spectrogram Fingerprinting by Wavelet Hashing. *International Conference on Acoustics, Speech and Signal Processing (ICASSP-2007).* ICASSP-2007
33. S. Baluja, M. Covell (2007) Learning "Forgiving" Hash Functions: Algorithms and Large Scale Tests, *International Joint Conference on Artificial Intelligence, 2007 (IJCAI).* IJCAI-2007
34. M. Kamvar, S. Baluja (2007), The Role of Context in Query Input: Using contextual signals to complete queries on Mobile Devices, *Proceedings of Mobile HCI 2007.* Mobile-HCI 2007.
35. Y.Jing, S. Baluja, H. Rowley (2007) Canonical Image Selection from the Web, *Conference on Image and Video Retrieval (CIVR-2007)* CIVR-2007
36. M. Covell, S. Baluja, M. Fink (2006), Advertisement Detection and Replacement using Acoustic and Visual Repetition, in *Proceedings of Multimedia Signal Processing, 2006.* MMSP-2006
37. S. Baluja, M. Covell (2006), Content Fingerprinting using Wavelets, in *Proceedings of Conference on Visual Media Production, 2006,* CVMP-2006 (invited)
38. S. Baluja (2006), Browsing on Small Screens: Recasting Web-Page Segmentation into an Efficient Machine Learning Framework, in *Proceedings of WWW-2006.* WWW-2006
39. M. Fink, M. Covell, S. Baluja (2006), Social- and Interactive-Television Applications Based on Real-Time Ambient-Audio Identification, **Best Paper Award**, in *Proceedings of Euro-ITV, 2006*. Euro-ITV 2006
40. M. Kamvar, S. Baluja (2006), A Large Scale Study of Wireless Search Behavior: Google Mobile Search, in *SIGCHI-2006: Computer Human Interaction*. CHI-2006
41. Rowley, H., Jing, Y., Baluja, S. (2006), Large-Scale Image-Based Adult-Content Filtering, *International Conference on Computer Vision Theory and Applications*. RJB-2006
42. S. Baluja, & H.Rowley (2005) Boosting Sex Identification Performance. *Proceedings of*

Innovative Applications of Artificial Intelligence, 2005: AAAI-IAAI 2005. IAAI 2005 (pdf)

43. S. Baluja & H. Rowley (2005) Large Scale Performance Measurement of Content-Based Automated Image-Orientation Detection. *Proceedings of the International Conference on Image Processing, 2005.* ICIP 2005 (pdf)
44. S. Baluja, M. Sahami, H. Rowley (2004) Efficient Face Orientation Discrimination. *Proceedings of the International Conference on Image Processing, 2004.* ICIP-2004 (pdf)
45. M. Sahami, V. Mittal, S. Baluja, H. Rowley (2004), The Happy Searcher: Challenges in Web Information Retrieval, To appear in: *Pacific Rim International Conference on Artificial Intelligence, 2004.* PRICAI-2004 (pdf)
46. T. Sim, R. Sukthankar, M. Mullin, S. Baluja (2000) Memory-based face recognition for visitor identification. *Proceedings of IEEE Face and Gesture, 2000.* ARENA-99
47. Baluja, S., Mittal, V. & Sukthankar, R. (1999) "Applying Machine Learning for High Performance Named Entity Extraction," appeared in *The Proceedings of the Pacific Association for Computational Linguistics (PACLING-99).* PACLING-99
48. Baluja, S. (1999) "Making Templates Rotationally Invariant: An Application to Rotated Digit Recognition", in M. S. Kearns, S. A. Solla, D. A. Cohn, eds *Advances in Neural Information Processing Systems 11,* MIT Press, 1999. NIPS-98
49. Baluja, S. (1999) "Probabilistic Modeling for Face Orientation Discrimination: Learning from Labeled and Unlabeled Examples" in M. S. Kearns, S. A. Solla, D. A. Cohn, eds., *Advances in Neural Information Processing Systems 11,* MIT Press, 1999. NIPS-98
50. Baluja, S. & Davies, S. (1998) "Fast Probabilistic Modeling for Combinatorial Optimization," in *Proceedings of the American Association of Artificial Intelligence, 1998. (AAAI-1998)*. AAAI-98
51. Baluja, S., (1998) "Using Expectation to Guide Processing: A Study of Three Real-World Applications" in M.I. Jordan, M. J. Kearns, S. A. Solla, eds., *Advances in Neural Information Processing Systems 10,* MIT Press, 1998. (Plenary Presentation). Neural Information Processing Systems 10
52. Rowley, H., Baluja, S. & Kanade, T. (1998) "Rotation Invariant Neural Network-Based Face Detection," in *Computer Vision and Pattern Recognition,* 1998. Also available as CMU-CS-97-201 via anonymous ftp at: reports.adm.cs.cmu.edu. Oral Presentation. CMU-CS-97-201 & JPRC-TR-97-001
53. Baluja, S. (1998) "Finding Regions of Uncertainty in Learned Models: An Application to Face Detection," in Eibenm Back, Schwefel, Schoenauer (eds.) *Lecture Notes in Computer Science Volume 1498, PPSN – Parallel Problem Solving from Nature.* (at Springer)
54. Baluja, S. & Davies, S. (1997) "Using Optimal Dependency-Trees for Combinatorial Optimization: Learning the Structure of the Search Space," in Fisher, D.H. (ed.), *Proceedings of the Fourteenth International Conference on Machine Learning, 1997* (ICML-97), pp. 30-38. Also available as CMU-CS-97-107 via. Anonymous ftp at: reports.adm.cs.cmu.edu. CMU-CS-97-107 ICML'97 Version
55. Sukthankar, R., Baluja, S., & Hancock, J. (1997) "Prototyping Intelligent Vehicle Modules," *The International Conference on Robotics and Automation, 1997 (ICRA-97).*
56. Baluja, S. (1997) "Genetic Algorithms and Explicit Search Statistics," in Mozer, M.C., Jordan, M.I., Petsche, T. (Eds.) *Advances in Neural Information Processing Systems 9,* MIT Press, Cambridge, MA. 1997. 319-325. Spotlight Presentation. NIPS-96
57. Rowley, H., Baluja, S., Kanade, T. (1996) "Neural Network Based Face Detection," in *Computer Vision and Pattern Recognition, 1996.* IEEE Computer Society, CA. 203-208. Oral Presentation. Compressed postscript **Longuet-Higgins prize for "a**

contribution that has stood the test of time." (2006).

58. Baluja, S. (1996) “An Empirical Comparison of Seven Iterative and Evolutionary Heuristics for Static Function Optimization (Extended Abstract),” *Proceedings of the Eleventh International Conference on Systems Engineering.* Howard. R. Hughes College of Engineering, University of Nevada at Las Vegas, 692-697. CMU-CS-95-193

59. Caruana, R., Baluja, S., Mitchell, T. (1996) “Using the Future to ‘Sort-Out’ The Present: Rankprop and Multitask Learning for Medical Risk Evaluation,” in Touretzky, D.S., Mozer, M.C., & Hasselmo, M.E. (eds.), *Advances in Neural Information Processing Systems 8.* MIT Press. pp. 959-965. Pneumonia-NIPS95

60. Rowley, H., Baluja, S., Kanade, T. (1996) “Human Face Detection in Visual Scenes,” in Touretzky, D.S., Mozer, M.C., & Hasselmo, M.E. (eds.), *Advances in Neural Information Processing Systems 8.* MIT Press. pp. 875-881. Face NIPS-95

61. Baluja, S. & Pomerleau, D.A. (1995) “Using the Representation in a Neural Network’s Hidden Layer for Task-Specific Focus of Attention,” C. Mellish (ed.) *The International Joint Conference on Artificial Intelligence 1995 (IJCAI-95):* Montreal, Canada. IJCAI & Morgan Kaufmann. San Mateo, CA. pp. 133-139. CMU-CS-95-143 (IJCAI-95)

62. Baluja, S. & Caruana, R. (1995) “Removing the Genetics from the Standard Genetic Algorithm,” In Prieditis, A., Russel, S.(eds) *The International Conference on Machine Learning 1995 (ML-95):* Lake Tahoe, California. 1995. Morgan Kaufmann Publishers. San Mateo, CA. pp. 38-46. Plenary Presentation. CMU-CS-95-141

63. Baluja, S. & Pomerleau, D.A. (1995) “Using a Saliency Map for Active Spatial Selective Attention: Implementation & Initial Results,” *Advances in Neural Information Processing Systems (NIPS) 7.* G. Tesauro, D.S. Touretzky and T.K. Leen, (eds.), MIT Press, Cambridge MA, 1995. 451-458. Oral Presentation (Plenary). (scanned)

64. Baluja, S. & Pomerleau, D.A. (1994) “Non-Intrusive Gaze Tracking Using Artificial Neural Networks,” *Advances in Neural Information Processing Systems (NIPS) 6*. Cowan, J.D., Tesauro, G. & Alspector, J. (eds.) Morgan Kaufmann Publishers, San Francisco, CA., 1994. Oral Presentation (Plenary). (TR: CMU-CS-94-102)

65. Baluja, S. (1993) “Structure and Performance of Fine Grain Parallelism in Genetic Search,” In S.Forrest (ed.), *Genetic Algorithms: Proceedings of the Fifth International Conference (ICGA93),* Morgan Kaufmann Publishers, San Mateo, CA., 1993. (TR: CMU-CS-92-196)

66. Baluja, S. (1993) “The Evolution of Genetic Algorithms: Towards Massive Parallelism,” in P.E. Utgoff, (ed.), *Machine Learning: Proceedings of the Tenth International Conference (ICML93),* Morgan Kaufmann Publishers, San Mateo, CA., 1993.

67. Baluja, S. & Scherer T. (1992) “Local Optimization Using Simulated Annealing,” *IEEE Systems, Man and Cybernetics Conference Proceedings,* 1992. IEEE Press. Invited Paper.

68. Liepins, G. & Baluja, S. (1992) “apGA: an Adaptive Parallel Genetic Algorithm,” *Computer Science and Operations Research, New Developments in Their Interfaces,* Balci, Sharda & Zenios (eds). Pergamon Press, 1992.

Other Publications

69. Sim, T., Sukthankar, R., Mullin, D., Baluja, S. (1999) “High Performance Memory-Based Face Recognition for Visitor Identification, Justsystem Pittsburgh Research Center Technical Report.

70. Baluja, S. (1997) “Face Detection with In-Plane Rotation: Early Concepts and Preliminary Results,” JPRC-TR-97-001. JPRC-TR-97-001

71. Baluja, S. & Davies, S. (1997) “Combining Multiple Optimization Runs with Optimal Dependency Trees,” CMU-CS-97-157. CMU-CS-97-157

72. Smith, M., Baluja, S., & Rowley, H. (1997) “Integrating Text and Face Detection for Finding Informative Poster Frames,” AAAI-96 Spring Symposium on Intelligent Integration and Use of Text, Image, Video and Audio Corpora. (symposium)

73. Sukthankar, R., Hancock, J., Baluja, S., Pomerleau D. & Thorpe C. (1996) “Adaptive Intelligent Vehicle Modules for Tactical Driving.” AAAI-96 Workshop on Intelligent Adaptive Agents. (Citeceer)

74. Baluja, S., & Simon, D. (1996) “Evolution-Based Methods for Object Localization: Applications to Computer Assisted Surgery,” CMU-CS-96-186.

75. Baluja, S. (1995) “An Empirical Comparison of Seven Iterative and Evolutionary Function Optimization Heuristics,” CMU-CS-95-193. Available via. anonymous ftp at: reports.adm.cs.cmu.edu. CMU-CS-95-193

76. Rowley, H., Baluja, S., Kanade, T. (1996) “Human Face Detection in Visual Scenes,” ARPA Image Understanding Workshop, 1996. Complete Report: CMU-CS-95-158R. Available via. anonymous ftp at: reports.adm.cs.cmu.edu.

77. Baluja, S. & Fahlman, S.E., (1994) “Reducing Network Depth in the Cascade-Correlation Learning Architecture,” CMU-CS-94-209. CMU-CS-94-209

78. Baluja, S. (1994) “Population-Based Incremental Learning: A Method for Integrating Genetic Search Based Function Optimization and Competitive Learning,” CMU-CS-94-163. Available via anonymous ftp at: reports.adm.cs.cmu.edu. CMU-CS-94-163

79. Jochem, T. & Baluja, S. (1993) “A Massively Parallel Road Follower,” The Proceedings of the Computer Architectures for Machine Perception Workshop (CAMP), 1993.

80. Pomerleau, D.A., Baluja, S. (1993) “Non-Intrusive Gaze Tracking Using Artificial Neural Networks,” AAAI Fall Symposium Series, Machine Learning in Computer Vision: What, Why and How?

81. Baluja, S. (1996) Expectation-Based Selective Attention, Ph.D. Thesis, Carnegie Mellon University. October 1996. Available as Carnegie Mellon Technical Report CMU-CS-96-182.

Academic and Student Fellowships

1995 **National Aeronautics and Space Administration Graduate Fellowship**. Administered by the Lyndon B. Johnson Space Center, Houston, TX.
1993 **National Science Foundation Graduate Student Fellowship.**
1993 Winner, International Mannheim SuParCup Massively Parallel Challenge Student Competitions. *Massively Parallel, Adaptive, Color Image Processing for Autonomous Road Following*. With Dr. Todd Jochem.
1993 National MasPar Grand Challenge Contest, second. With Todd Jochem.
1990 Department of Energy Research Semester Fellowship, Oak Ridge National Laboratory.
1990 Winner of the 1990 Fall Oak Ridge National Laboratory Scientific Research Award.

Teaching Experience

Details available upon request.