

# Curriculum Vitae

Claus Brøndgaard Madsen

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# 1 EDUCATION AND EXPERIENCE

**Full name:** Claus Brøndgaard Madsen  
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## 1.1 EDUCATION

**M.Sc. in Electronic Engineering**, october 1990  
Specialized in image analysis/computer vision  
Institute of Electronic Systems  
Aalborg University, Aalborg, Denmark  
Thesis title:  
*Qualitative 3D Scene Modelling*  
Grade: 13 (of 13)

**Ph.D. in Computer Science and Engineering**, September 1994  
Institute of Electronic Systems  
Aalborg University, Aalborg, Denmark  
Thesis title:  
*Reactive View Planning for Quantification of Local Geometry*  
Supervisor: associate prof. Henrik I. Christensen  
Thesis committee:  
Prof. Jan-Olof Eklundh, KTH, Stockholm, Sweden  
Prof. Knut Conradsen, DTU, Copenhagen, Denmark

## 1.2 EMPLOYMENT

- November 1990 to January 1994:** Research assistant and Ph.D. student  
Laboratory of Image Analysis, Aalborg University  
Aalborg, Denmark  
Under Prof. E. Granum/Assoc. Prof. H. I. Christensen
- October 1994 to April 1995:** Post doctoral fellow  
Institute of Systems and Robotics, University of Coimbra  
Coimbra, Portugal  
Under Assoc. Prof. Helder Araujo
- May 1995 to August 1995:** Post doctoral fellow  
Computational Vision and Active Perception Laboratory  
Royal Institute of Technology, Stockholm, Sweden  
Under Prof. Jan-Olof Eklundh
- September 1995 to August 1998:** Assistant professor  
Laboratory of Image Analysis, Aalborg University  
Aalborg, Denmark
- September 1998 to February 2000:** Associate research professor (Post Doc)  
Laboratory of Computer Vision and Media Technology  
Aalborg University, Aalborg, Denmark  
Funded by "Staging of Virtual 3D Worlds" (national research project), and "PUPPET: The Educational Puppet Theatre of Virtual Worlds" (EU project)
- March 2000 to present:** Associate professor  
Laboratory of Computer Vision and Media Technology  
Aalborg University, Aalborg, Denmark

## 1.3 ADDITIONAL EXPERIENCE

- January 1990 to may 1990:** Visiting student  
Oak Ridge National Laboratory  
Oak Ridge, Tennessee, USA  
Under Dr. Judson P. Jones
- October 1992 to may 1993:** Visiting researcher  
University of South Florida  
Tampa, Florida, USA  
Under Prof. Kevin W. Bowyer

## 2 PROFESSIONAL ACTIVITIES

### 2.1 RESEARCH PROJECTS AND FUNDING

- 1996 to 2001: co-principal investigator on the EU TMR project VIRGO, Vision-Based Robot Navigation Research Network, which for the Laboratory of Image Analysis, Aalborg University was a 1 man-year per year project.
- 1997: principal author on an application securing external funding for the purchase of a robot arm. The application was rewarded with approx. 60.000 USD.
- 1998: co-proposer on a project proposal, "PUPPET: The Educational Puppet Theatre of Virtual Worlds", for the EU I3-ESE programme. The project got funding.
- 1997 to 2000: technical manager, and contributing programmer, on the "Staging of Virtual 3D Worlds" research project. 1998 to 2001: worked in the same capacity on the "PUPPET: The Educational Puppet Theatre of Virtual Worlds" research project.
- February 2002: co-proposer on project proposal, "BENOGO: Being There Without Going", for the EU IST-FET programme. Project funded with 2M Euro.
- October 2002 to present: co-principal investigator and technical manager on the BENOGO project.
- September 2004: co-proposer on project proposal, "CoSPE: Computer Vision Based Scene Parameter Estimation" for the Danish Technical Research Council. Project funded with 300.000 Euro.
- April 2005: principal author on an application securing external funding for the purchase of image acquisition and other equipment for Augmented Reality projects. The application was rewarded with approx. 35.000 USD.

### 2.2 CONFERENCE PROGRAM COMMITTEES

On the programme committee of the International Conference on Vision Systems in 1999, (ICVS'99).

On the programme committee of the Scandinavian Conference on Image Analysis in 2003, (SCIA'03).

On the programme committee of the Second Workshop on Empirical Evaluation Methods on Computer Vision. The workshop was held in conjunction with the European Conference on Computer Vision (ECCV 2000), Dublin, Ireland.

## **2.3 TECHNICAL REVIEWER**

Claus Madsen regularly serves as technical reviewer for:

- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Systems, Man, and Cybernetics
- IEE Proceedings – Vision, Image and Signal Processing
- Computer Vision and Image Understanding
- Machine Vision and Applications
- Image and Vision Computing
- Pattern Recognition
- International Journal of Pattern Recognition and Artificial Intelligence
- European Conference on Computer Vision
- International Conference on Pattern Recognition
- Scandinavian Conference on Image Analysis
- Workshop on Visual Form
- International Symposium on Intelligent Robotic Systems
- Eurographics

## **2.4 PROFESSIONAL MEMBERSHIPS**

- IEEE (The Institute of Electrical and Electronics Engineers)
- IEEE Computer Society
- IEEE Robotics and Automation Society
- IAPR (International Association for Pattern Recognition)
- DSAGM Danish Society for Automated Recognition of Patterns
- Serves on the ECVnet panel of industrial consultants on vision technology.  
ECVnet is the European Computer Vision Network of Excellence

### 3 TEACHING EXPERIENCE

Has attended a three-semester course (150 hours total including preparation and allotted self-studies) in *University Paedagogy for Assistant Professors* at Center for Teaching Enhancement, Aalborg University.

Nominated for Best Teacher award by the Institute of Electronic Systems' study board for the year 2002 and 2003.

#### Class teaching:

- *Computer Vision Techniques* for 5th year students at Laboratory of Computer Vision and Media Technology, Aalborg University, (CVMT/AAU).
- *3D Computer Graphics* for 5th year students on the game programmer's Master's programme at the Institute of Computer Science, Aalborg University, (CS/AAU).
- *Introduction to Computer Graphics* for 4th year students at Institute for Electronic Systems, Aalborg University, (IES/AAU).
- *Virtual Reality* for 5th year students at IES/AAU.
- *Introduction to Graph Theory* for 5th year students at IES/AAU.
- Lecture series in *Advanced Linear Algebra* for faculty staff and Ph.D. students at CVMT/AAU.
- Teaching assistant duties in *Abstract Algebra* for 4'th year students at IES/AAU.

#### Student supervision:

- Ph.D. student Lars Brix doing a project on virtual reality surgery simulation.
- Ph.D. student Salvatore Livatino in conjunction with the VIRGO mobile robotics TMR-project.
- Supervision of M.Sc. projects in Computer Vision and Virtual Reality every year for 5th year students at IES/AAU.
- Supervision of student projects related to Computer Vision for students at various levels at IES/AAU.
- Supervision of student projects in *Analog and Digital Electronics*, (design, analysis, simulation, implementation and test of analog amplifier and filtering circuits, and digital circuitry), for 2nd year students at IES/AAU.
- Regularly supervise foreign exchange students in 6 month projects in Computer Vision, Mobile Robotics, Computer Graphics and Virtual Reality.

## 4 PERSONAL REFERENCES

The following people have agreed to act as references for me. My association with each follows from the previous description of my education and employment history. Please feel free to contact these people to inquire about me and/or my work.

Prof. Erik Granum  
Laboratory of Image Analysis  
Institute of Electronic Systems  
Aalborg University  
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## 5 PUBLICATIONS

The following is a complete list of all publications I have authored or co-authored. The publications are divided into five categories: 1) international journals, 2) books and book chapters, 3) international conferences and workshops, 4) regional conferences and workshops, and 5) technical reports. The latter category only features entries containing technical or experimental material not covered by entries of the four other categories.

### 5.1 JOURNAL PUBLICATIONS

- [1] C. B. Madsen and H. I. Christensen. A dynamic method for estimating the stability of edge segment orientation. *Pattern Recognition Letters*, page (13), 2000. In preparation.
- [2] C. B. Madsen. Direct computation of true angle probabilities from single perspective views of polyhedral objects. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, page (7), July 1997. Being revised.
- [3] C. B. Madsen and C. S. Andersen. Optimal landmark selection for triangulation of robot position. *Robotics and Autonomous Systems*, 23(4):277 – 292, July 1998.
- [4] C. B. Madsen. A comparative study of the robustness of two pose estimation techniques. *Machine Vision and Applications, special issue on performance characterization*, 5/6(9):291 – 303, 1997.
- [5] C. B. Madsen and H. I. Christensen. A viewpoint planning strategy for determining true angles on polyhedral objects by camera alignment. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 19(2):158 – 164, February 1997.
- [6] H. I. Christensen and C. B. Madsen. Purposive reconstruction: a reply to ”a computational and evolutionary perspective on the role of representation in vision”. *Computer Vision, Graphics and Image Processing: Image Understanding*, 60(1):102 – 108, July 1994.
- [7] C. S. Andersen, C. B. Madsen, J. J. Sørensen, N. O. S. Kirkeby, J. P. Jones, and H. I. Christensen. Navigation using range images on a mobile robot. *Robotics and Autonomous Systems*, (10):147 – 160, October 1992.

### 5.2 BOOKS AND BOOK CHAPTERS

- [1] C. B. Madsen. Supporting interactive dramaturgy in virtual environment for small children. In L. Qvortrup et al., editor, *Virtual Application: Applications With Virtual Inhabited 3D Worlds*, chapter 5, pages 89 – 116. Springer, 2003.

- [2] J. F. Jensen, E. Kjems, N. Lehmann, C. B. Madsen, and L. Qvortrup, editors. *Virtual Space: Spatiality in Virtual Inhabited 3D Worlds*. Springer, 2002.
- [3] C. B. Madsen and E. Granum. Aspects of interactive autonomy and perception. In L. Qvortrup et al., editor, *Virtual Interaction: Interaction in Virtual Inhabited 3D Worlds*, chapter 2, pages 182–209). Springer, 2000.
- [4] H. I. Christensen, W. Förstner, and C. B. Madsen, editors. *Proceedings: ECVnet Workshop on Performance Characteristics of Vision Algorithms*. European Network of Excellence in Computer Vision, ECVNet, April 1996. Held in conjunction with Fourth European Conference on Computer Vision, Cambridge, England.
- [5] C. B. Madsen and H. I. Christensen. Modelling and testing the stability of edge segments: Length and orientation. In Gunilla Borgefors, editor, *Theory & Applications of Image Analysis II - Selected papers from the 9'th Scandinavian Conference on Image Analysis*, chapter 1 (Edges and Curves), pages 1 – 15. World Scientific Press, 1995. ISBN: 981-02-2448-6.
- [6] C. B. Madsen. *Reactive View Planning for Quantification of Local Geometry*. PhD thesis, Laboratory of Image Analysis, Institute of Electronic Systems, Aalborg University, Fr. Bajers Vej 7D, DK-9220 Aalborg Ø, Denmark, October 1994.
- [7] C. B. Madsen and N. O. Jørgensen. Qualitative 3D scene modelling. Master's thesis, Laboratory of Image Analysis, Institute of Electronic Systems, Aalborg University, Fr. Bajers Vej 7D, DK-9220 Aalborg Ø, Denmark, October 1990. (No existing Tech. Rep. number).

### 5.3 INTERNATIONAL CONFERENCE PUBLICATIONS

- [1] Y. Liu, M. Störring, T. B. Moeslund, C. B. Madsen, and E. Granum. Computer vision based head tracking from re-configurable 2d markers for ar. In *Proceedings: 2nd International Symposium on Mixed and Augmented Reality*, pages 264 – 265, October 2003.
- [2] C. B. Madsen, M. K. D. Sørensen, and M. Vittrup. The importance of shadows in augmented reality. In *Proceedings: 6th Annual International Workshop on Presence, Aalborg, Denmark*, page (4 pages), October 2003.
- [3] C. B. Madsen, M. K. D. Sørensen, and M. Vittrup. Estimating positions and radiances of a small number of light sources for real-time image-based lighting. In *Proceedings: Annual Conference of the European Association for Computer Graphics, EUROGRAPHICS 2003, Granada, Spain*, pages 37 – 44, September 2003.

- [4] Y. Liu, C. B. Madsen, and M. Störring. An extended perspective three points problem. In *Proceedings: 13th Scandinavian Conference on Image Analysis (SCIA 2003), Göteborg, Sweden*, pages 75 – 82, June/July 2003.
- [5] C. B. Madsen. Using real shadows to create virtual ones. In *Proceedings: 13th Scandinavian Conference on Image Analysis (SCIA 2003), Göteborg, Sweden*, pages 820 – 827, June/July 2003.
- [6] C. B. Madsen. Detecting, adding, and removing shadows for augmented reality. In *Proceedings: Conference on Image and Vision Computing New Zealand (IVCNZ'02), Auckland, New Zealand*, pages 7 – 13, November 2002.
- [7] J. Arnsfang, D. Benyon, M. Fahle, E. Granum, C. B. Madsen, T. Pajdla, M. Smyth, P. Turner, S. Turner, and D. Weinshall. An investigation into virtual representations of real places. In *Proceedings: Fifth Annual International Workshop on Presence Research (PRESENCE 2002), Porto, Portugal*, page (8 pages), October 2002.
- [8] P. Paggio, B. Jongejan, and C. B. Madsen. Unification-based multimodal analysis in a 3d virtual world: the staging project. In *Proceedings: Twente Workshop on Language Theory, "Interacting Agents", Twente, The Netherlands*, page (13), October 2000.
- [9] S. Livatino and C. B. Madsen. Acquisition and recognition of visual landmarks for autonomous robot navigation. In *Proceedings: International Symposium on Intelligent Robotic Systems, Reading, United Kingdom*, pages 269 – 279, July 2000.
- [10] S. Livatino and C. B. Madsen. Autonomous robot navigation with automatic learning of visual landmarks. In *Proceedings: International Symposium on Intelligent Robotic System, Coimbra, Portugal*, pages 419 – 428, July 1999.
- [11] S. Livatino and C. B. Madsen. Optimization of robot self-localization accuracy by automatic visual landmark selection. In *Proceedings: 11th Scandinavian Conference on Image Analysis, Sdr. Strømfjord, Greenland*, pages 501 – 506, June 1999.
- [12] C. B. Madsen, P. Pirjanian, and E. Granum. Can finite state automata, numeric mood parameters and reactive behaviours become alive? In *Proceedings: Workshop on Behavior Planning for Life-Like Characters and Avatars, held in conjunction with the I3 Spring Days, Sitges, Spain*, page (4), March 1999.
- [13] S. Livatino and C. B. Madsen. Automatic selection of visual landmarks for mobile robot navigation. In Orphanoudakis et al., editor, *Proceedings: Computer Vision and Mobile Robotics Workshop, Santorini, Greece*, pages 1 – 8, September 1998.

- [14] C. S. Andersen, C. B. Madsen, J. Thorsteinn, and O. Stefansson. Landmark based navigation strategies. In *Proceedings: SPIE, Mobile Robots XIII and Intelligent Transportation Systems, Boston, USA*, volume 3525, pages 171 – 180. SPIE, November 1998.
- [15] C. B. Madsen, C. S. Andersen, and J. S. Sørensen. A robustness analysis of triangulation-based robot self-positioning. In *Proceedings: International Symposium on Intelligent Robotic Systems, Stockholm, Sweden*, pages 195 – 204, July 1997. Elected to appear as extended version in later issue of the journal of Robotics and Autonomous Systems.
- [16] H. Birk, T. Moeslund, and C. B. Madsen. Real-time recognition of hand alphabet gestures using principal component analysis. In *Proceedings: 10th Scandinavian Conference on Image Analysis, Lappeenranta, Finland*, pages 261 – 268, June 1997.
- [17] C. B. Madsen. Viewpoint variation in the noise sensitivity of pose estimation. In *Proceedings: IEEE Conference on Computer Vision and Pattern Recognition, San Francisco, California*, pages 41 – 46, June 1996.
- [18] C. B. Madsen. A comparative study of the robustness of two pose estimation techniques. In H. I. Christensen, W. Förstner, and C. B. Madsen, editors, *Proceedings: ECVnet Workshop on Performance Characteristics of Vision Algorithms, held in conjunction with Fourth European Conference on Computer Vision, Cambridge, England*, pages 181 – 200, April 1996.
- [19] C. B. Madsen and H. I. Christensen. Modelling and testing the stability of edge segments: Length and orientation. In *Proceedings: Ninth Scandinavian Conference On Image Analysis, Uppsala, Sweden*, pages 1011 – 1019, June 1995.
- [20] C. B. Madsen and H. I. Christensen. Reactive view planning for quantification of local geometry. In *Proceedings: IEEE Conference on Computer Vision and Pattern Recognition, Seattle, Washington*, pages 823 – 828, June 1994.
- [21] C. B. Madsen and H. I. Christensen. Localizing un-calibrated, reactive camera motion in an object centered coordinate system. In *Proceedings: IEEE Workshop on Visual Behaviours in conjunction with the IEEE Conference on Computer Vision and Pattern Recognition, Seattle, Washington*, pages 119 – 123, June 1994.
- [22] C. B. Madsen and H. I. Christensen. Determining angles with a movable observer. In *Proceedings: IEEE International Conferences on Pattern Recognition, Jerusalem, Israel*, pages 280 – 285, October 1994.
- [23] C. B. Madsen and H. I. Christensen. Qualitative scene models from sparse 3D data. In *Proceedings: Eighth Scandinavian Conference on Image Analysis, Tromsø, Norway*, pages 427 – 433, May 1993.

- [24] J. P. Jones, O. Dørum, C. S. Andersen, S. B. Jacobsen, M. S. Jensen, N. O. S. Kirkeby, S. Kristensen, C. B. Madsen, H. M. Nielsen, E. Sørensen, J. J. Sørensen, and H. I. Christensen. Experiments in mobile robot navigation and range imaging. In *Proceedings: Eighth Scandinavian Conference on Image Analysis, Tromsø, Norway*, pages 371 – 387, May 1993. Invited paper.
- [25] C. S. Andersen, C. B. Madsen, J. J. Sørensen, N. O. S. Kirkeby, J. P. Jones, and H. I. Christensen. Laser range guided robot vehicle. In *Proceedings: Second Nordic Workshop on Industrial Machine Vision*, March 1992.
- [26] C. B. Madsen and H. I. Christensen. A graph based approach to 3D qualitative scene modelling. In *Proceedings: Seventh Scandinavian Conference on Image Analysis, Aalborg, Denmark*, pages 324 – 337, August 1991.

#### 5.4 REGIONAL CONFERENCE PUBLICATIONS

- [1] C. B. Madsen and Rune Laursen. Image relighting: Getting the sun to set in an image taken at noon. In S. I. Olsen, editor, *Proceedings: 13th Danish Conference on Pattern Recognition and Image Analysis, Copenhagen, Denmark*, page (8 pages), August 2004.
- [2] C. B. Madsen, M. K. D. Sørensen, and M. Vittrup. Realistic lighting for real-time rendering. In S. I. Olsen, editor, *Proceedings: 12th Danish Conference on Pattern Recognition and Image Analysis, Copenhagen, Denmark*, pages 102 – 111, August 2003.
- [3] Y. Liu, M. Störring, T. B. Moeslund, C. B. Madsen, and E. Granum. Computer vision based head tracking from re-configurable 2d markers for ar. In S. I. Olsen, editor, *Proceedings: 12th Danish Conference on Pattern Recognition and Image Analysis, Copenhagen, Denmark*, pages 50 – 58, August 2003.
- [4] M. Störring, T. B. Moeslund, C. B. Madsen, and E. Granum. Computer vision in the arthur project. In S. I. Olsen, editor, *Proceedings: Eleventh Danish Conference on Pattern Recognition and Image Analysis, Copenhagen, Denmark*, pages 99 – 107, August 2002.
- [5] C. B. Madsen. Can non-existing objects cast shadows? In S. I. Olsen, editor, *Proceedings: Eleventh Danish Conference on Pattern Recognition and Image Analysis, Copenhagen, Denmark*, pages 137 – 144, August 2002.
- [6] S. Livatino and C. B. Madsen. Automatic selection of visual landmarks for mobile robot navigation. In P. Johansen, editor, *Proceedings: Seventh Danish Conference on Pattern Recognition and Image Analysis, Copenhagen, Denmark*, pages 69 – 75, August 1998.
- [7] C. B. Madsen. Viewpoint variation in the noise sensitivity of pose estimation. In P. Johansen, editor, *Proceedings: Fifth Danish Conference on*

*Pattern Recognition and Image Analysis, Copenhagen, Denmark*, pages 116 – 121, August 1996.

- [8] C. B. Madsen. Object pose estimation (in-)stability. In P. Johansen, editor, *Proceedings: Fourth Danish Conference on Pattern Recognition and Image Analysis, Copenhagen, Denmark*, pages 88 – 97, August 1995.
- [9] C. B. Madsen and H. I. Christensen. Determining angles with a movable observer. In *Proceedings: Third Danish Conference on Pattern Recognition and Image Processing, Copenhagen, Denmark*, pages 107 – 119, August 1994.
- [10] C. B. Madsen and H. I. Christensen. Active vision strategies for qualitative angle classification. In *Proceedings: Second Danish Conference on Pattern Recognition and Image Processing, Copenhagen, Denmark*, pages 101 – 109, August 1993.
- [11] C. B. Madsen. Qualitative scene modelling and active vision. In H. I. Christensen, editor, *Proceedings: Nordic Summer School on "Active Vision and Geometric Modeling"*, pages 215 – 224, September 1992.
- [12] C. S. Andersen, H. I. Christensen, N. O. S. Kirkeby, L. F. Knudsen, and C. B. Madsen. Vinav: a system for vision supported navigation. In H. I. Christensen, editor, *Proceedings: Nordic Summer School on "Active Vision and Geometric Modeling"*, pages 251 – 257, September 1992.
- [13] C. B. Madsen and H. I. Christensen. Qualitative shape description and reconstruction from sparse 3D data. In *Proceedings: First Danish Conference on Pattern Recognition and Image Processing, Copenhagen, Denmark*, pages 112 – 119, June 1992.
- [14] C. S. Andersen, H. I. Christensen, N. O. S. Kirkeby, L. F. Knudsen, and C. B. Madsen. Vinav: Et system for vision støttet navigation. In *Proceedings: First Danish Conference on Pattern Recognition and Image Processing, Copenhagen, Denmark*, pages 99 – 104, June 1992. In danish.

## 5.5 TECHNICAL REPORTS

- [1] P. Pirjanian, C. B. Madsen, and E. Granum. Behaviour-based control of an interactive life-like pet. Technical report, Laboratory of Image Analysis, December 1998. Not published.
- [2] C. B. Madsen and H. I. Christensen. Probability guided viewpoint planning strategy for determining true angles on polyhedral objects. Technical Report LIA-96-6, Laboratory of Image Analysis, Aalborg University, Fr. Bajers Vej 7 D1, DK-9220 Aalborg East, Denmark, September 1996. Shorter version appears in IEEE-TPAMI, Vol. 19, No. 2, February, 1997.

- [3] C. B. Madsen. Malt: Move and learn things, vol. 13: Visual potential of tri-hedral vertices. Technical report, Instituto de Sistemas e Robótica, Universidade de Coimbra, PT-3000 Coimbra, Portugal, March 1995. (no. unknown).
- [4] C. B. Madsen. Quasimodo. Technical Report LIA-92-22, Laboratory of Image Analysis, Aalborg University, Fr. Bajers Vej 7D, DK-9220 Aalborg Ø, Denmark, May 1992.