

# Table of Contents

## Oral Session 1: CAD

|                                                                                                                                           |    |
|-------------------------------------------------------------------------------------------------------------------------------------------|----|
| Impact of CAD with Full Field Digital Mammography on Workflow and Cost .....                                                              | 1  |
| <i>Paul Taylor, Henry Potts, Louise Wilkinson, and Rosalind Given-Wilson</i>                                                              |    |
| Performance of Triple-Modality CADx on Breast Cancer Diagnostic Classification .....                                                      | 9  |
| <i>Neha Bhooshan, Maryellen L. Giger, Karen Drukker, Yading Yuan, Hui Li, Stephanie McCann, Gillian Newstead, and Charlene Sennett</i>    |    |
| Needle Path Planning Method for Digital Breast Tomosynthesis Biopsy Based on Probabilistic Techniques .....                               | 15 |
| <i>Laurence Vancamberg, Anis Sahbani, Serge Muller, and Guillaume Morel</i>                                                               |    |
| X-ray Mammography - MRI Registration Using a Volume-Preserving Affine Transformation and an EM-MRF for Breast Tissue Classification ..... | 23 |
| <i>Thomy Mertzanidou, John H. Hipwell, M. Jorge Cardoso, Christine Tanner, Sebastien Ourselin, and David J. Hawkes</i>                    |    |

## Oral Session 2: Image Processing and Analysis I

|                                                                                                                           |    |
|---------------------------------------------------------------------------------------------------------------------------|----|
| Interactive Multi-scale Contrast Enhancement of Previously Processed Digital Mammograms .....                             | 31 |
| <i>Fabian Zöhrer, Markus T. Harz, Anke Bödicker, Heike Seyffarth, Kathy J. Schilling, László Tabár, and Horst K. Hahn</i> |    |
| Lesion Segmentation in Breast Sonography .....                                                                            | 39 |
| <i>Joan Massich, Fabrice Meriaudeau, Elsa Pérez, Robert Martí, Arnau Oliver, and Joan Martí</i>                           |    |
| Mammogram Compression Using Super-Resolution .....                                                                        | 46 |
| <i>Jun Zheng, Olac Fuentes, Ming-Ying Leung, and Elais Jackson</i>                                                        |    |
| Development of an Ensemble of Digital Breast Object Models .....                                                          | 54 |
| <i>J. Michael O'Connor, Mini Das, Clay Didier, Mufeed Mah'd, and Stephen J. Glick</i>                                     |    |
| Analysis of Geometric Accuracy in Digital Breast Tomosynthesis Reconstruction .....                                       | 62 |
| <i>Predrag R. Bakic, Peter Ringer, Johnny Kuo, Susan Ng, and Andrew D.A. Maidment</i>                                     |    |

## Oral Session 3: Breast Imaging Physics

|                                                                                                                                                                                                                    |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Results of Comprehensive Dose Survey for Mammography.....                                                                                                                                                          | 70  |
| <i>Paola Baldelli, James B. McCullagh, Niall Phelan, and Fidelma Flanagan</i>                                                                                                                                      |     |
| Validation of a Simulated Dose Reduction Methodology Using Digital Mammography CDMAM Images and Mastectomy Images.....                                                                                             | 78  |
| <i>Mary Yip, Federica Zanca, Alistair Mackenzie, Adam Workman, Kenneth C. Young, David R. Dance, Hilde Bosmans, Emma Lewis, and Kevin Wells</i>                                                                    |     |
| Measured Dose versus Organ Dose Performance in Digital Mammography Systems.....                                                                                                                                    | 86  |
| <i>James B. McCullagh, Paola Baldelli, and Niall Phelan</i>                                                                                                                                                        |     |
| Noise Reduction in Dual-Energy Contrast Enhanced Digital Breast Tomosynthesis Using Regularization.....                                                                                                            | 92  |
| <i>Răzvan Iordache, Maélène Lohezic, Giovanni Palma, Sylvie Puong, and Serge Muller</i>                                                                                                                            |     |
| Phantom Dose Levels Found at Annual Physics Surveys in a National Mammography Screening Program: Comparison of Doses from Analog and Digital Equipment and from Digital Equipment at Different Points in Time..... | 100 |
| <i>Kristin Pedersen, Ingrid D. Landmark, Kirsti Bredholt, Ingrid H.R. Hauge, and Hilde M. Olerud</i>                                                                                                               |     |

## Poster Session 1

|                                                                                                                                                                                                                                                               |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Task-Based Evaluation of Image Quality of Filtered Back Projection for Breast Tomosynthesis .....                                                                                                                                                             | 106 |
| <i>Xinying Wang, James G. Mainprize, Gang Wu, and Martin J. Yaffe</i>                                                                                                                                                                                         |     |
| A Comparative Study of the Inter-reader Variability of Breast Percent Density Estimation in Digital Mammography: Potential Effect of Reader's Training and Clinical Experience .....                                                                          | 114 |
| <i>Emily F. Conant, Diane Li, Sara Gavenonis, Predrag R. Bakic, Ann-Katherine Carton, Cuiping Zhang, Andrew D.A. Maidment, and Despina Kontos</i>                                                                                                             |     |
| Concepts for Efficient and Reliable Multi-modal Breast Image Reading .....                                                                                                                                                                                    | 121 |
| <i>Horst K. Hahn, Markus T. Harz, Heike Seyffarth, Fabian Zöhrer, Tobias Böhrer, Konstantinos Filippatos, Lei Wang, André Homeyer, Felix Ritter, Hendrik Laue, Matthias Günther, Thorsten Twellmann, László K. Tabár, Ulrich Bick, and Kathy J. Schilling</i> |     |

|                                                                                                                                                                                                       |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Modeling the Impact of CAD on the Outcomes of the UK Breast Screening Programme .....                                                                                                                 | 129 |
| <i>Paul Taylor</i>                                                                                                                                                                                    |     |
| Introducing a Novel Image Quality Measure for Digital Phase-Contrast-Image Evaluation .....                                                                                                           | 137 |
| <i>Satoru Matsuo, Hiroshi Fujita, Junji Morishita, and Tetsuro Katafuchi</i>                                                                                                                          |     |
| Modelling Structural Deformations in Mammographic Tissue Using the Dual-Tree Complex Wavelet .....                                                                                                    | 145 |
| <i>Michael Berks, Chris Taylor, Rumana Rahim, Caroline Boggis, and Susan Astley</i>                                                                                                                   |     |
| Classification of Linear Structures in Mammograms Using Random Forests .....                                                                                                                          | 153 |
| <i>Zezhi Chen, Michael Berks, Susan Astley, and Chris Taylor</i>                                                                                                                                      |     |
| Should CAD Be Used as a Second Reader? – Exploring Two Alternative Reading Modes for CAD in Screening Mammography .....                                                                               | 161 |
| <i>Richard Lederman, Isaac Leichter, Eli Ratner, Menachem Abramov, Alexandra Manevich, and Jonathan Stoeckel</i>                                                                                      |     |
| Automated Assessment of Area of Dense Tissue in the Breast: A Comparison with Human Estimation .....                                                                                                  | 168 |
| <i>Camilla Jeffries-Chung, Jennifer Diffey, Michael Berks, Joanna Morrison, Rosanne Verow, Julie Morris, Mary Wilson, Caroline Boggis, Nicky Barr, Anthony Maxwell, Alan Hufton, and Susan Astley</i> |     |
| Local Greylevel Appearance Histogram Based Texture Segmentation ...                                                                                                                                   | 175 |
| <i>Reyer Zwiggelaar</i>                                                                                                                                                                               |     |
| Quantification of Vascular Calcifications on Digitized Mammograms ....                                                                                                                                | 183 |
| <i>Enrique Nava, Irene Barba, Francisco Sendra, and Celestino Gómez-Rebollo</i>                                                                                                                       |     |
| Comparison of Tilt Correction Methods in Full Field Digital Mammograms .....                                                                                                                          | 191 |
| <i>Michiel Kallenberg and Nico Karssemeijer</i>                                                                                                                                                       |     |
| Optimising Beam Quality Selection in Mammographic Acquisition Using the Standard Attenuation Rate .....                                                                                               | 197 |
| <i>Christopher E. Tromans, Jennifer Diffey, Mary Cocker, and Sir Michael Brady</i>                                                                                                                    |     |
| Investigating the Replacement of the Physical Anti-scatter Grid with Digital Image Processing .....                                                                                                   | 205 |
| <i>Christopher E. Tromans, Jennifer Diffey, and Sir Michael Brady</i>                                                                                                                                 |     |

|                                                                                                                                                                                   |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Diffusion-Weighted Imaging (DWI) for Breast Cancers; Challenging to Diagnose Ductal Carcinoma in Situ (DCIS) and Invasive Lobular Carcinoma (ILC) .....                           | 213 |
| <i>Yoshifumi Kuroki, Katsuhiko Nasu, Seiko Kuroki, Ryuzo Sekiguchi, Shigeru Nawano, and Mitsuo Satake</i>                                                                         |     |
| CR Mammography: Image Quality Measurement and Model Calculation for Needle vs. Powder Imaging Plate .....                                                                         | 219 |
| <i>Dirk A.N. Vandenbroucke and Paul J.R. Leblans</i>                                                                                                                              |     |
| Performance Assessment of Breast Tomosynthesis Systems: Concepts for Two Types of Phantoms .....                                                                                  | 227 |
| <i>Hilde Bosmans, Jurgen Jacobs, Eman Shaheen, Federica Zanca, Lesley Cockmartin, Kristina Bliznakova, Kim Lemmens, Sabrina Vollmar, Willi A. Kalender, and Nicholas Marshall</i> |     |
| Realistic Simulation of Microcalcifications in Breast Tomosynthesis .....                                                                                                         | 235 |
| <i>Eman Shaheen, Chantal Van Ongeval, Lesley Cockmartin, Federica Zanca, Nicholas Marshall, Jurgen Jacobs, and Hilde Bosmans</i>                                                  |     |
| Breast Tomosynthesis Reconstruction Using a Grid of Blobs with Projection Matrices .....                                                                                          | 243 |
| <i>Gang Wu, James G. Mainprize, and Martin J. Yaffe</i>                                                                                                                           |     |
| A Boosting Based Approach for Automatic Micro-calcification Detection .....                                                                                                       | 251 |
| <i>Arnau Oliver, Albert Torrent, Meritxell Tortajada, Xavier Lladó, Marta Peracaula, Lidia Tortajada, Melcior Sentís, and Jordi Freixenet</i>                                     |     |
| Automatic Breast Tissue Classification Based on BIRADS Categories .....                                                                                                           | 259 |
| <i>Gloria Bueno, Noelia Vázquez, Óscar Déniz, Pablo Esteve, Miguel A. Rienda, and Carlos Pastor</i>                                                                               |     |
| Validation of Mammographic Texture Analysis for Assessment of Breast Cancer Risk .....                                                                                            | 267 |
| <i>Hui Li, Maryellen L. Giger, Olufunmilayo I. Olopade, and Li Lan</i>                                                                                                            |     |
| Towards Learning Spiculation Score of the Masses in Mammography Images .....                                                                                                      | 272 |
| <i>Inna Stainvas, Jonathan Stoeckel, Eli Ratner, Menachem Abramov, and Richard Lederman</i>                                                                                       |     |

|                                                                                                                                                                                                        |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Three Digital Mammography Display Configurations: Observer Performance in a Pilot ROC Study .....                                                                                                      | 280 |
| <i>László K. Tabár, Alfredo S. Niño, Eric Schreiber, Richard Ellis, Cynthia Goralnik, Steven Scislaw, Raja Cheruvu, Deepa Masrani, Daoxian Zhang, Steve Muller, and Patrick Heffernan</i>              |     |
| How Can Image Quality Affect the Detection Performance of Breast CAD (Computer Aided Detection) in FFDM (Full Field Digital Mammography)? – A Comparative Study with Two Different FFDM Systems- ..... | 288 |
| <i>Nachiko Uchiyama, Jonathan Stoeckel, Kyoichi Otsuka, Seiko Kuroki, Yukio Muramatsu, and Noriyuki Moriyama</i>                                                                                       |     |
| Feature Point Detection for Non-rigid Registration of Digital Breast Tomosynthesis Images .....                                                                                                        | 296 |
| <i>Weiwei Zhang and Sir Michael Brady</i>                                                                                                                                                              |     |
| Contrast Detail Curves on Digital Mammography: Performance Comparison of Raw and Filtered Images .....                                                                                                 | 304 |
| <i>Pedro Collado-Chamorro, Camilo Sanz-Freire, José Gómez-Amez, Alejandro Vázquez-Galiñanes, Natalia Lopo-Casqueiro, and Maria González-De La Puente</i>                                               |     |
| Reader Fatigue Interpreting Mammograms .....                                                                                                                                                           | 312 |
| <i>Elisabeth A. Krupinski</i>                                                                                                                                                                          |     |
| Adapting Clinical Images to Appear with Different Noise and Sharpness to Model a Different Detector .....                                                                                              | 319 |
| <i>Alistair Mackenzie, Adam Workman, David R. Dance, Mary Yip, Kevin Wells, and Kenneth C. Young</i>                                                                                                   |     |
| <b>Oral Session 4: Physics Models</b>                                                                                                                                                                  |     |
| Human Observer Performance in a Single Slice or a Volume: Effect of Background Correlation.....                                                                                                        | 327 |
| <i>Ingrid Reiser and Robert M. Nishikawa</i>                                                                                                                                                           |     |
| Influence of Geometrical Factors on Phase Contrast Fiber Images .....                                                                                                                                  | 334 |
| <i>Margarita Chevalier, Lorena Chanes, Eduardo Guibelalde, María-Ester Brandan, and Tatiana Alieva</i>                                                                                                 |     |
| Robust Breast Composition Measurement - Volpara <sup>TM</sup> .....                                                                                                                                    | 342 |
| <i>Ralph Highnam, Sir Michael Brady, Martin J. Yaffe, Nico Karssemeijer, and Jennifer Harvey</i>                                                                                                       |     |
| <b>Oral Session 5: Clinical Experiences</b>                                                                                                                                                            |     |
| Technical Evaluation of a Digital Breast Tomosynthesis System .....                                                                                                                                    | 350 |
| <i>Nicholas Marshall, Jurgen Jacobs, Lesley Cockmartin, and Hilde Bosmans</i>                                                                                                                          |     |

Mammographic Interpretation Training: How Could Low Cost Display Devices Help? ..... 357  
*Yan Chen and Alastair Gale*

A Survey of Patient Doses from Digital Mammography Systems in the UK in 2007 to 2009 ..... 365  
*Jennifer M. Oduko, Kenneth C. Young, and Anna Burch*

Analysis of Mammography Quality Control Results: Evidence for a Change in Test Frequency? ..... 371  
*Koen Michielsen, Jurgen Jacobs, Nicholas Marshall, and Hilde Bosmans*

A Comparative Study of Volumetric and Area-Based Breast Density Estimation in Digital Mammography: Results from a Screening Population ..... 378  
*Despina Kontos, Predrag R. Bakic, Raymond J. Acciavatti, Emily F. Conant, and Andrew D.A. Maidment*

**Oral Session 6: Breast Density**

Volumetric Breast Density and Breast Cancer Risk Factors in a Screening Population ..... 386  
*Jennifer Diffey, Joanna Morrison, Michael Berks, Joanne Greene, Julie Morris, Anthony Maxwell, Caroline Boggis, Alan Hufton, and Susan Astley*

Determinants and Consequences of Change in Breast Density ..... 394  
*Mona Jeffreys, Ruth Warren, Ralph Highnam, and George Davey Smith*

Comparison of Subregional Breast Density with Whole Breast Density ..... 402  
*Sergei Malkov, Lin Ma, Karla Kerlikowske, Jeff Wang, Steve Cummings, and John Shepherd*

Comparing a New Volumetric Breast Density Method (Volpara™) to Cumulus ..... 408  
*Mona Jeffreys, Jennifer Harvey, and Ralph Highnam*

Visual Assessment of Density in Digital Mammograms ..... 414  
*Anisha Sukha, Michael Berks, Julie Morris, Caroline Boggis, Mary Wilson, Nicky Barr, and Susan Astley*

**Oral Session 7: Digital Breast Tomosynthesis**

Concepts for High-Resolution CT of the Breast ..... 421  
*Willi A. Kalender*

|                                                                                                                                                                                           |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Optimised Breast Tomosynthesis with a Novel CMOS Flat Panel Detector .....                                                                                                                | 428 |
| <i>Steve Naday, Edward F. Bullard, Spencer Gunn, James E. Brodrick, Eoin O. O'Tuairisg, Alan McArthur, Hamdan Amin, Mark B. Williams, Patricia G. Judy, and Anastasios Konstantinidis</i> |     |
| Calculation of OTF, NPS, and DQE for Oblique X-ray Incidence on Turbid Granular Phosphors .....                                                                                           | 436 |
| <i>Raymond J. Acciavatti and Andrew D.A. Maidment</i>                                                                                                                                     |     |
| Scanner for Integrated X-ray Breast Tomosynthesis and Molecular Breast Imaging Tomosynthesis .....                                                                                        | 444 |
| <i>Mark B. Williams, Patricia G. Judy, Zongyi Gong, Audrey E. Graham, Stan Majewski, and Spencer Gunn</i>                                                                                 |     |
| An Anthropomorphic Software Breast Phantom for Tomosynthesis Simulation: Power Spectrum Analysis of Phantom Projections .....                                                             | 452 |
| <i>Predrag R. Bakic, Beverly Lau, Ann-Katherine Carton, Ingrid Reiser, Andrew D.A. Maidment, and Robert M. Nishikawa</i>                                                                  |     |
| <br><b>Poster Session 2</b>                                                                                                                                                               |     |
| Comparison of Two Novel FFDM Systems with Different a-Se Detector Technology: Physical Characterization and Phantom Contrast Detail Evaluation in Clinical Conditions .....               | 459 |
| <i>Nadia Oberhofer, Alessandro Fracchetti, Elvina Nassivera, Aldo Valentini, and Ehrenfried Moroder</i>                                                                                   |     |
| Development of a Peripheral Thickness Estimation Method for Volumetric Breast Density Measurements in Mammography Using a 3D Finite Element Breast Model .....                            | 467 |
| <i>Olivier Alonzo-Proulx, James G. Mainprize, Nathan J. Packard, John M. Boone, Adil Al-Mayah, Kristy Brock, and Martin J. Yaffe</i>                                                      |     |
| Is CAD Able to Assist in the Detection of Subtle Breast Findings – Lobular Cancers, and T1a/T1b Masses in Dense Breasts? ...                                                              | 474 |
| <i>Isaac Leichter, Zahava Gallimidi, Asnat Heyman-Reiss, Nicolas Merlet, Eli Ratner, Menachem Abramov, Inna Stainvas, and Richard Lederman</i>                                            |     |
| Towards More Realistic Biomechanical Modelling of Tumours under Mammographic Compressions .....                                                                                           | 481 |
| <i>Carolina Wessel, Julia A. Schnabel, and Sir Michael Brady</i>                                                                                                                          |     |

|                                                                                                                                                                            |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Scoring Systems in Computer-Based Training for Digital Mammography .....                                                                                                   | 490 |
| <i>Paul Taylor, Mark Hartwood, Lilian Blot, Rob Procter, and Stuart Anderson</i>                                                                                           |     |
| The Effect of Slab Size on Mass Detection Performance of a Screen-Film CAD System in Reconstructed Tomosynthesis Volumes .....                                             | 497 |
| <i>Guido van Schie, Karin Leifland, Matthew Wallis, Elin Moa, Magnus Hemmendorff, and Nico Karssemeijer</i>                                                                |     |
| Synthesising Malignant Breast Masses in Normal Mammograms .....                                                                                                            | 505 |
| <i>Michael Berks, Chris Taylor, Rumana Rahim, David Barbosa da Silva, Caroline Boggis, and Susan Astley</i>                                                                |     |
| Comparison of Microcalcification Detection Rates and Recall Rates in Digital and Analogue Mammography .....                                                                | 513 |
| <i>Nicola Barr, Caroline Boggis, Nicky Barr, Mary Wilson, Julie Morris, Michael Berks, and Susan Astley</i>                                                                |     |
| Constancy Checking of Digital Breast Tomosynthesis Systems .....                                                                                                           | 518 |
| <i>Jurgen Jacobs, Nicholas Marshall, Lesley Cockmartin, Ehsan Samei, and Hilde Bosmans</i>                                                                                 |     |
| Mammographic Image Segmentation and Risk Classification Using a Novel Texture Signature Based Methodology .....                                                            | 526 |
| <i>Wenda He, Erika R.E. Denton, and Reyer Zwiggelaar</i>                                                                                                                   |     |
| Stratified Sampling for Case Selection Criteria for Evaluating CAD.....                                                                                                    | 534 |
| <i>Robert M. Nishikawa and Lorenzo L. Pesce</i>                                                                                                                            |     |
| Breast Shapes on Real and Simulated Mammograms .....                                                                                                                       | 540 |
| <i>Christine Tanner, John H. Hipwell, David J. Hawkes, and Gábor Székely</i>                                                                                               |     |
| Regularization Parameter Selection in Maximum a Posteriori Iterative Reconstruction for Digital Breast Tomosynthesis .....                                                 | 548 |
| <i>Anna K. Jerebko, Markus Kowarschik, and Thomas Mertelmeier</i>                                                                                                          |     |
| Image Quality Phantom in Close Compliance with the ICRU-44 Breast Tissue Substitute Standard and Realistic Background Noise Pattern for Digital Breast Tomosynthesis ..... | 556 |
| <i>Steven Raeymaeckers, Nico Bult, Gert Van Gompel, Cathérine Breucq, and Johan de Mey</i>                                                                                 |     |
| The Standard Attenuation Rate for Quantitative Mammography .....                                                                                                           | 561 |
| <i>Christopher E. Tromans and Sir Michael Brady</i>                                                                                                                        |     |



|                                                                                                                                                                             |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| National Software Supported Quality Assurance Program in Digital Mammography: Experiences and Challenges .....                                                              | 569 |
| <i>Christian Moll, Andreas Jahnen, Alex Meyer, Martine Grelot, Johannes Hermen, Carlo Back, Marie-Christine Wagnon, and Norbert Rösch</i>                                   |     |
| Inter and Intra Observer Variability in a Semi-automatic Method for Measuring Volumetric Breast Density .....                                                               | 576 |
| <i>Rosanne Verow, Michael Berks, Jennifer Diffey, Camilla Chung, Joanna Morrison, Mary Wilson, Caroline Boggis, Nicky Barr, Julie Morris, Alan Hufton, and Susan Astley</i> |     |
| Optimization of the Exposure Parameters with Signal-to-Noise Ratios Considering Human Visual Characteristics in Digital Mammography ...                                     | 583 |
| <i>Maki Yamada, Yuri Kato, Naotoshi Fujita, and Yoshie Kodera</i>                                                                                                           |     |
| Ideal Observer Comparison between Tomographic and Projection x-Ray Images of the Breast .....                                                                               | 591 |
| <i>John M. Boone, Nathan J. Packard, and Craig K. Abbey</i>                                                                                                                 |     |
| Breast Structural Noise in Digital Breast Tomosynthesis and Its Dependence on Reconstruction Methods .....                                                                  | 598 |
| <i>Yue-Houng Hu, Michael Masiar, and Wei Zhao</i>                                                                                                                           |     |
| Dual-Energy Dividing Mammography .....                                                                                                                                      | 606 |
| <i>Vjacheslav Gorshkov, Nadezhda Rozhkova, and Sergey Prokopenko</i>                                                                                                        |     |
| Effect of BI-RADS Assessment in Improving CAD of Masses .....                                                                                                               | 614 |
| <i>Antonio García-Manso, Carlos J. García-Orellana, Ramón Gallardo-Caballero, Horacio González-Velasco, and Miguel Macías-Macías</i>                                        |     |
| Analysis of the Benefit/Risk Ratio Obtained in the Valencian Breast Early Detection Program During 2007 and 2008 .....                                                      | 622 |
| <i>Ricardo Tortosa, Juan Ignacio Villaescusa, Miguel Ramos, and Gumersindo Verdú</i>                                                                                        |     |
| Monte Carlo Simulation of Scatter Field for Calculation of Contrast of Discs in Synthetic CDMAM Images .....                                                                | 628 |
| <i>Oliver Díaz, Mary Yip, Jorge Cabello, David R. Dance, Kenneth C. Young, and Kevin Wells</i>                                                                              |     |
| Classifying Breast Masses in Volumetric Whole Breast Ultrasound Data: A 2.5-Dimensional Approach .....                                                                      | 636 |
| <i>Gobert N. Lee, Toshiaki Okada, Daisuke Fukuoka, Chisako Muramatsu, Takeshi Hara, Takako Morita, Etsuo Takada, Tokiko Endo, and Hiroshi Fujita</i>                        |     |

A Supplement to the European Guidelines for Quality Assurance in Breast Cancer Screening and Diagnosis ..... 643  
*Ruben E. van Engen, Kenneth C. Young, Hilde Bosmans, Barbara Lazzari, Stephan Schopphoven, Patrice Heid, and Martin A. Thijssen*

Investigation of Practical Scoring Methods for Breast Density ..... 651  
*Baorui Ren, Andrew P. Smith, and Julian Marshall*

Performance of the New Double Layer Amorphous Selenium Detector for Digital Mammography Compared to the FDA Approved CR System for Digital Mammography ..... 659  
*Rafael Salvador, Rafael Salvador-Izquierdo, Leonardo Romero, Xavier Salvador-Izquierdo, and Manuel Salvador*

**Oral Session 8: Image Processing and Analysis II**

Machine Learning Techniques and Mammographic Risk Assessment .... 664  
*Neil Mac Parthaláin and Reyer Zwiggelaar*

Automatic BI-RADS Description of Mammographic Masses ..... 673  
*Fabián Narváez, Gloria Díaz, and Eduardo Romero*

A Clustering Method for the Extraction of Microcalcifications Using Epipolar Curves in Digital Breast Tomosynthesis ..... 682  
*Candy P.S. Ho, Christopher E. Tromans, Julia A. Schnabel, and Sir Michael Brady*

**Oral Session 9: Lesion Detection**

Software Framework for Simulating Clusters of Microcalcifications in Digital Mammography ..... 689  
*Federica Zanca, Guozhi Zhang, Nicholas Marshall, Eman Shaheen, Elena Salvagnini, Guy Marchal, and Hilde Bosmans*

Improved Microcalcification Detection for Breast Tomosynthesis Using a Penalized-Maximum-Likelihood Reconstruction Method ..... 697  
*Mini Das, Howard C. Gifford, J. Michael O'Connor, and Stephen J. Glick*

Microcalcification Detection in Digital Breast Tomosynthesis Using an Epipolar Curve Approach ..... 704  
*Candy P.S. Ho, Christopher E. Tromans, Julia A. Schnabel, and Sir Michael Brady*

Spiculated Lesions and Architectural Distortions Detection in Digital Breast Tomosynthesis Datasets ..... 712  
*Giovanni Palma, Isabelle Bloch, and Serge Muller*

|                                                                                           |     |
|-------------------------------------------------------------------------------------------|-----|
| An Observer Model for Lesion Detectability in Contrast-Enhanced Digital Mammography ..... | 720 |
| <i>Melissa L. Hill, James G. Mainprize, and Martin J. Yaffe</i>                           |     |

## Oral Session 10: Registration

|                                                                                                                                                                       |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Fast Deformation Simulation of Breasts Using GPU-Based Dynamic Explicit Finite Element Method .....                                                                   | 728        |
| <i>Lianghao Han, John H. Hipwell, Zeike A. Taylor, Christine Tanner, Sebastien Ourselin, and David J. Hawkes</i>                                                      |            |
| Breast Image Registration by Combining Finite Elements and Free-Form Deformations .....                                                                               | 736        |
| <i>Angela W.C. Lee, Julia A. Schnabel, Vijay Rajagopal, Poul M.F. Nielsen, and Martyn P. Nash</i>                                                                     |            |
| The Effect of Motion Correction on Pharmacokinetic Parameter Estimation .....                                                                                         | 744        |
| <i>Andrew Melbourne, John H. Hipwell, and David J. Hawkes</i>                                                                                                         |            |
| Improved Detection of Cancer in Screening Mammograms by Temporal Comparison .....                                                                                     | 752        |
| <i>Fei Ma, Mariusz Bajger, Simon Williams, and Murk J. Bottema</i>                                                                                                    |            |
| Combined Reconstruction and Registration of Digital Breast Tomosynthesis .....                                                                                        | 760        |
| <i>Guang Yang, John H. Hipwell, Matthew J. Clarkson, Christine Tanner, Thomy Mertzanidou, Spencer Gunn, Sebastien Ourselin, David J. Hawkes, and Simon R. Arridge</i> |            |
| <b>Author Index .....</b>                                                                                                                                             | <b>769</b> |