

PHOTOACOUSTIC BREAST TOMOGRAPHY: TOWARDS MONITORING OF NEOADJUVANT CHEMOTHERAPY RESPONSE

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MULTI-MODALITY MEDICAL IMAGING (M3I)
TECH MED CENTRE
UNIVERSITY OF TWENTE

DISCLOSURE

NO FINANCIAL INTERESTS TO DISCLOSE



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Rianne Bulthuis (PhD)



photoacoustics, ultrasound,
phantoms, patient studies

Bruno DeSanti (Post-Doc)



image analysis, image registration,
deep learning



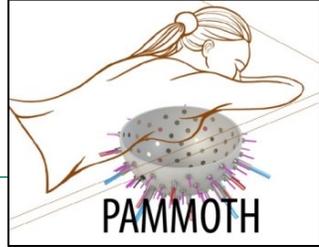
NEO-ADJUVANT CHEMOTHERAPY

- Chemotherapy, targeted therapy, or hormone therapy, before primary treatment
- To achieve:
 - Tumor shrinkage and downstaging
 - Lymph node management
 - Evaluation of treatment response
- NAC administered in cycles, with each cycle typically lasting a few weeks

PHOTOACOUSTIC IMAGING - PAM3 SYSTEM



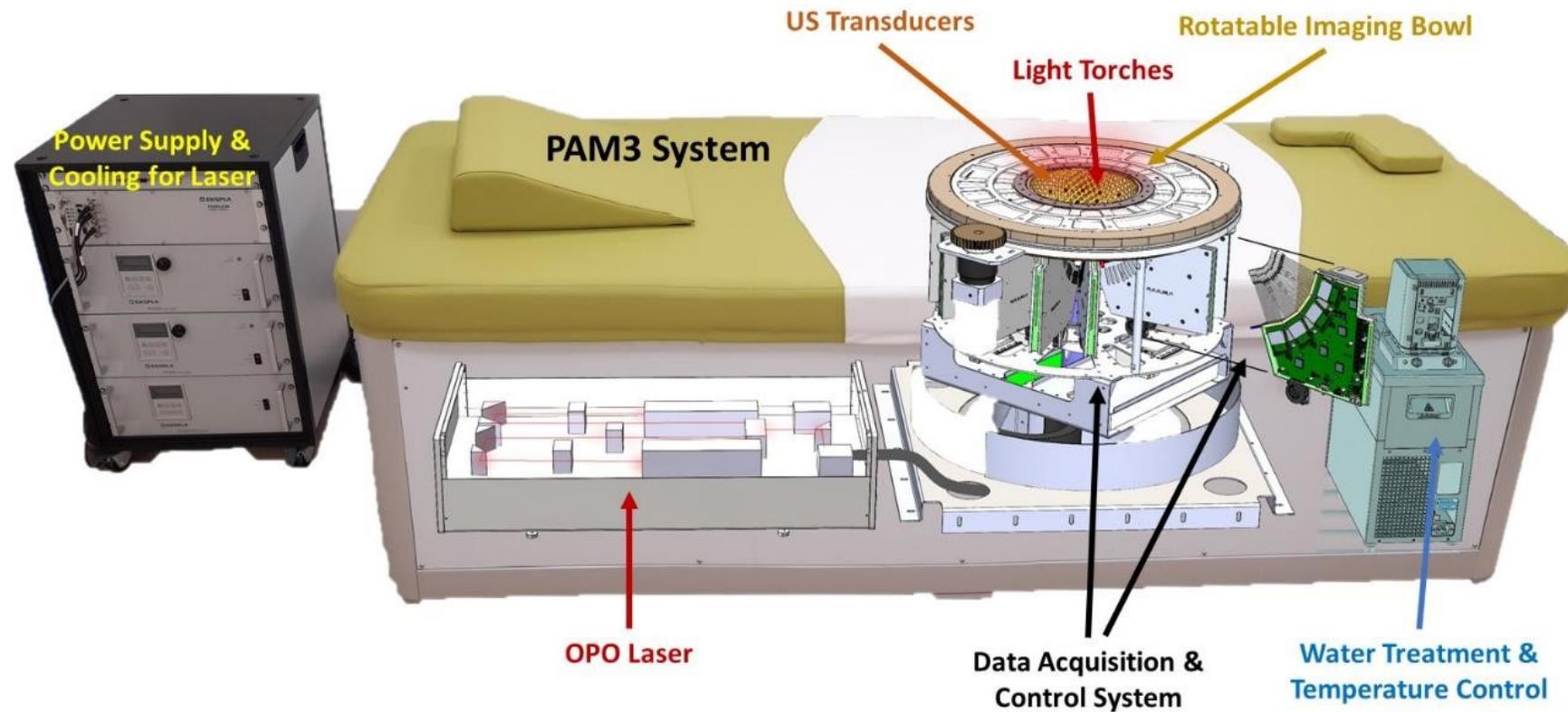
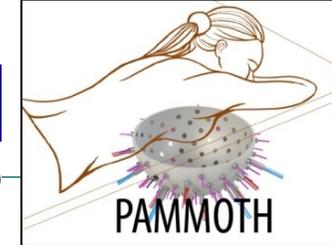
H2020-ICT-29-2016
nr. 732411



PHOTOACOUSTIC IMAGING - PAM3 SYSTEM



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CHALLENGES IN PHOTOACOUSTIC BREAST IMAGING



acquisition

reconstruction

image

image analysis

interpretation

integrated
decision-forming



challenge 1

hybrid
standardized

challenge 2

quantitative

challenge 3

visualization
static/kinetic

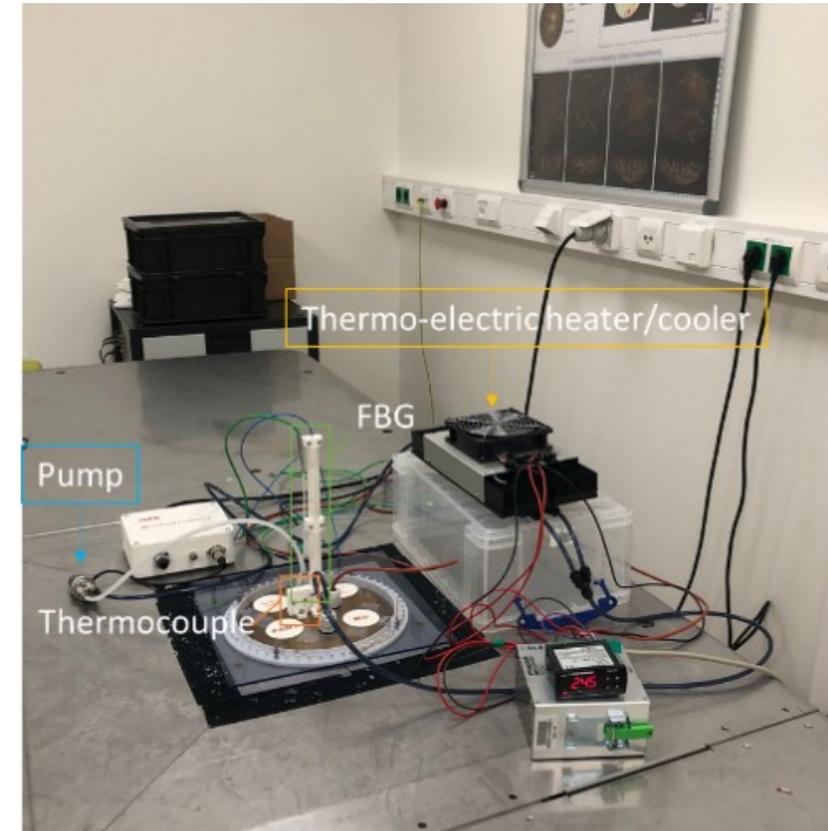
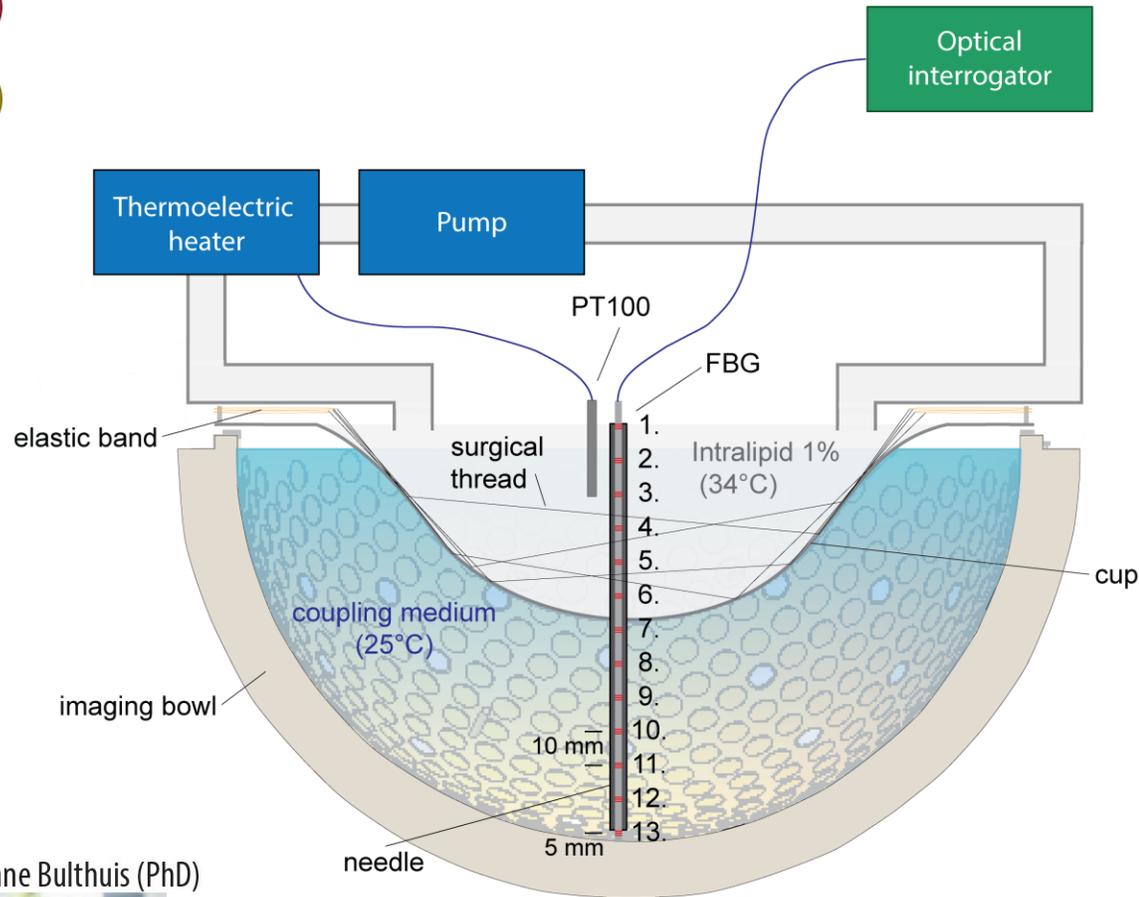
challenge 4

biomarkers
quantitative

challenge 5

classification

STANDARDIZATION1 – REPEATABILITY IN IMAGER CHARACTERISTICS



Rianne Bulthuis (PhD)



Bruno DeSanti (Post-Doc)

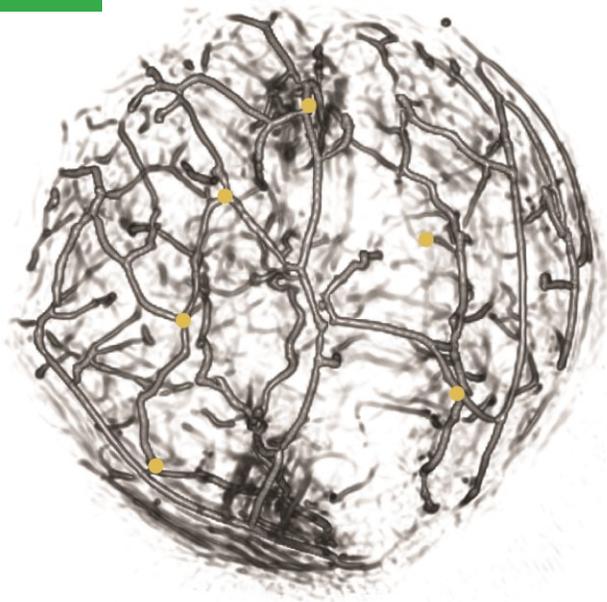


image analysis, image registration,
deep learning

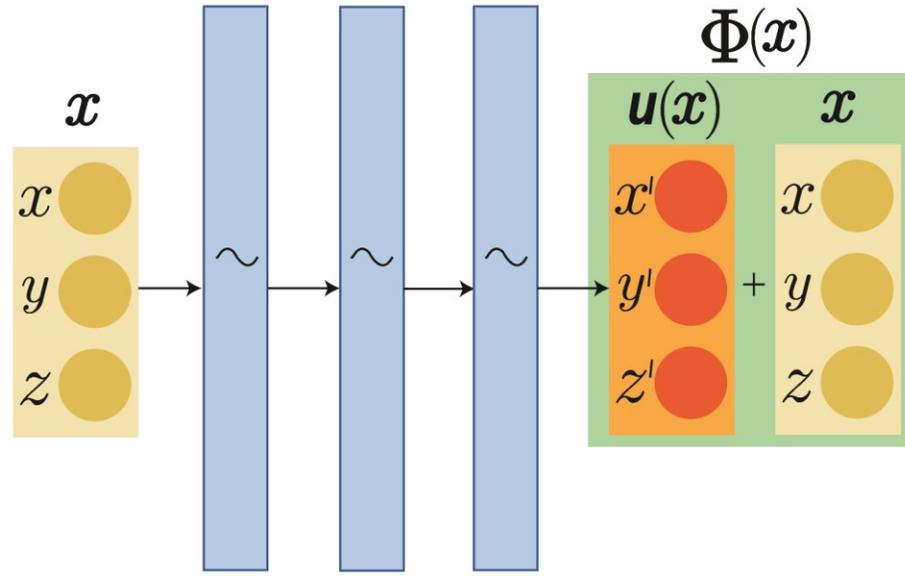
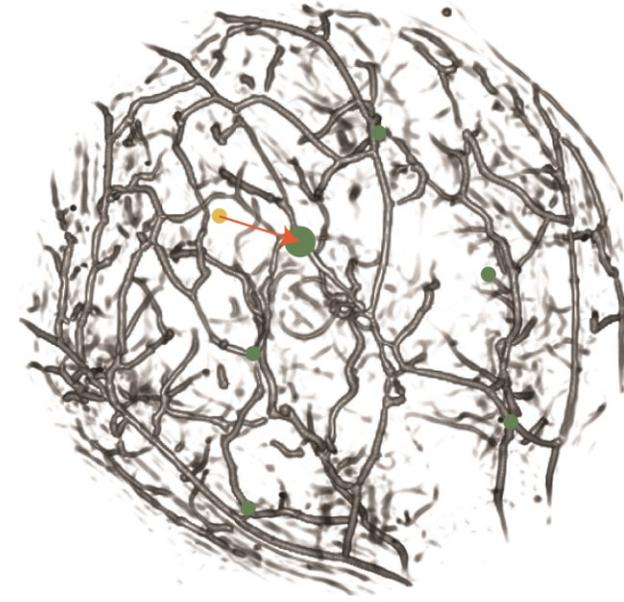
STANDARDIZATION2 – REPEATABILITY IN POSITIONING BREAST

REGISTRATION OF IMAGES

Fixed image



Moving image



Similarity metric

$$NCC = \frac{1}{N} \frac{\sum_i (f - \bar{f})(m - \bar{m})}{\sigma_f \sigma_m}$$

Activation Function

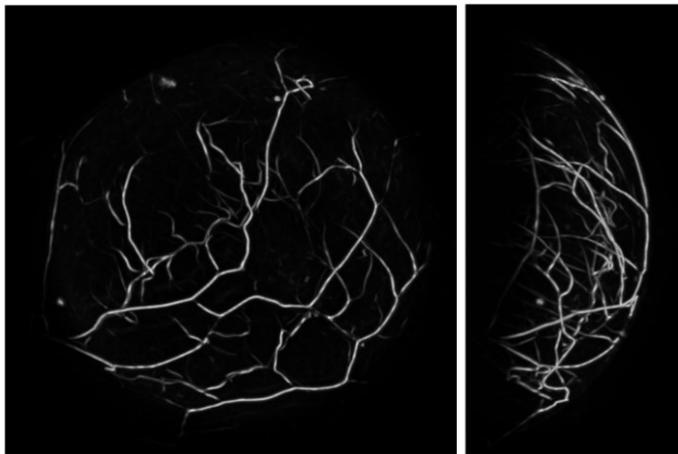
$$y = \sin(\omega W x + b)$$

Regularization

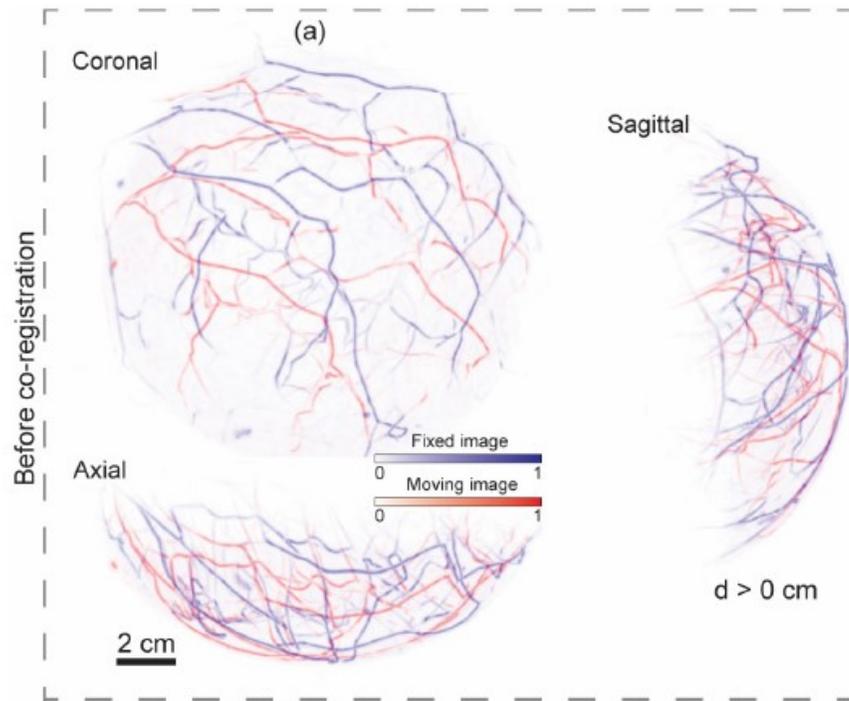
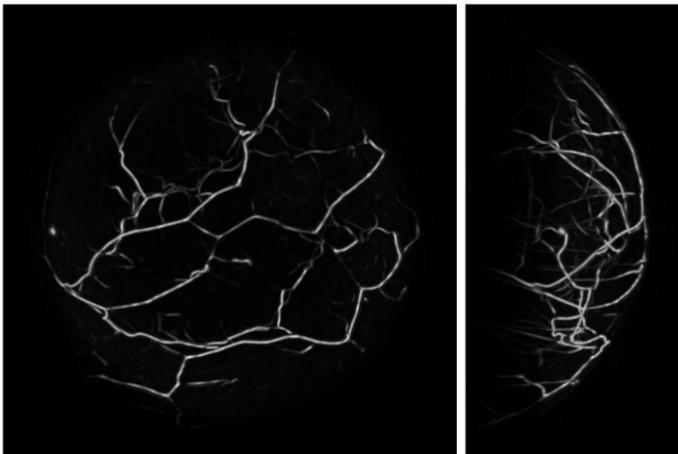
$$S^{\text{elas}}[u] = \int_{\Omega} \nu(\text{tr}V)^2 + \mu \text{tr}(V^2) dx$$

with $V = V(u) = (\nabla u + \nabla u^T)/2$

Reference image



Moving image



Bruno DeSanti (Post-Doc)



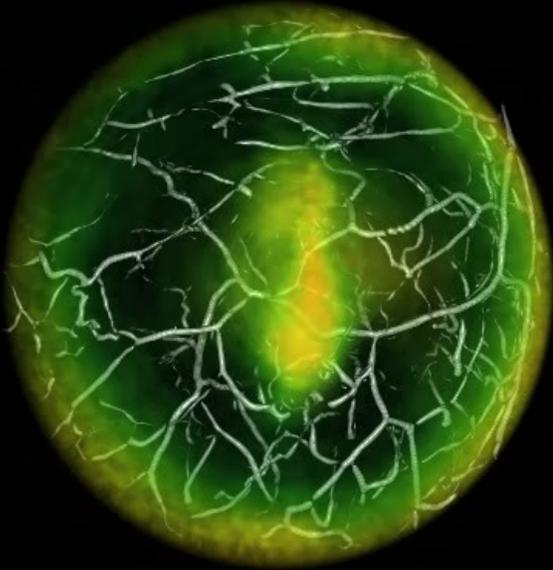
image analysis, image registration,
deep learning

Lucia Kim (BME Master)



image analysis, deep learning
patient studies

Hybrid imaging overlay



CLOSING THOUGHTS

Device repeatability

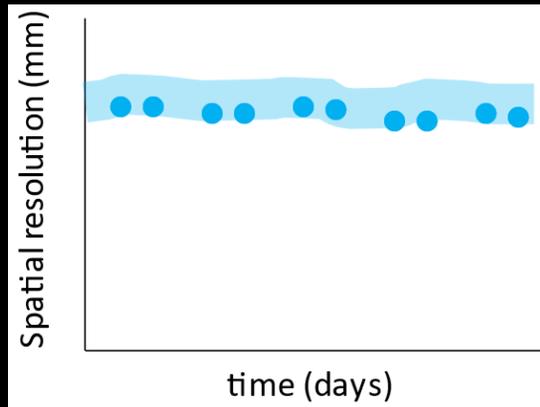


Image registration

