QBI Project Microcalcifications

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Overview

1. Leading causes of breast cancer
2. Mammography
3. Microcalcifications
4. Our goal
5. Description of the workflow, node by node
6. Results

Cancer rates

- Breast cancer is the most common cancer in women
- It's the second leading cause of cancer deaths worldwide
- Early detection is fundamental!

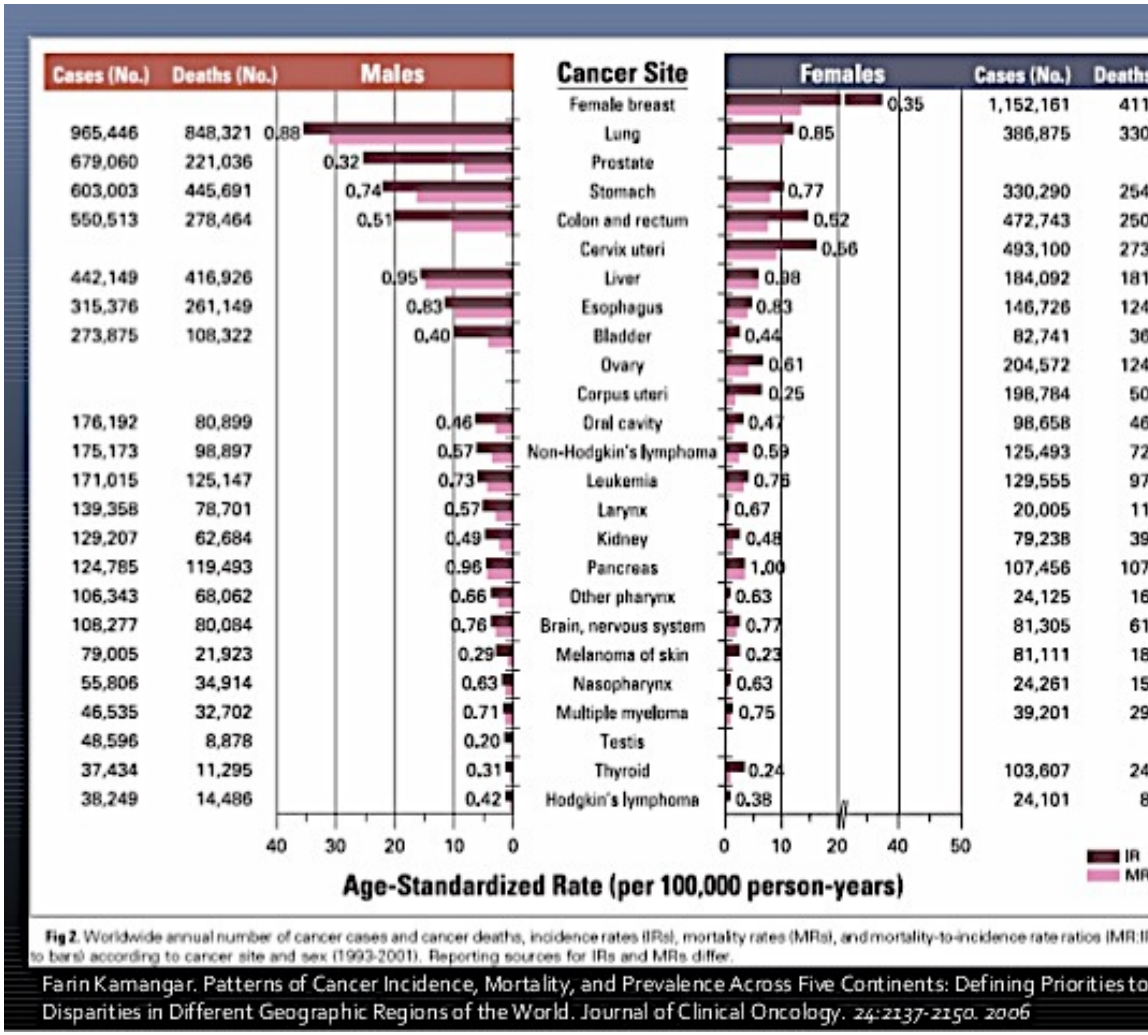
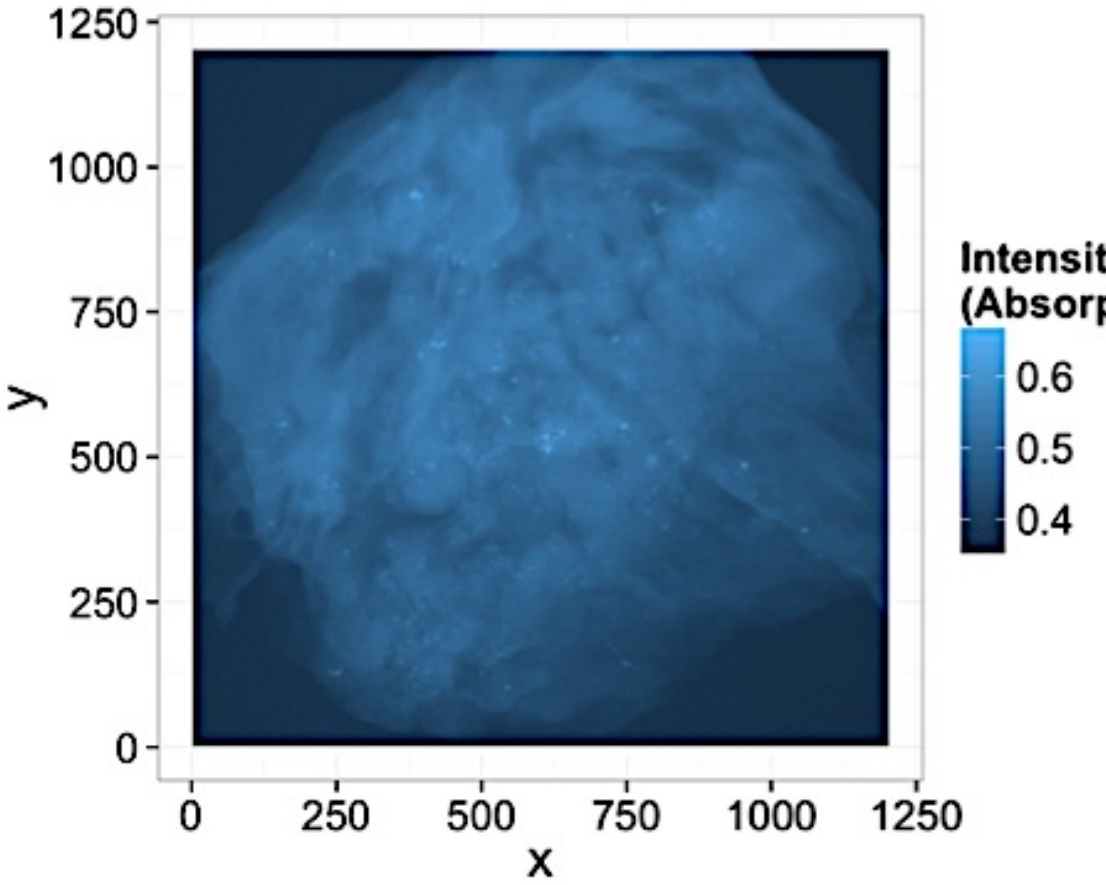


Fig 2. Worldwide annual number of cancer cases and cancer deaths, incidence rates (IRs), mortality rates (MRs), and mortality-to-incidence rate ratios (MR:I
to bars) according to cancer site and sex (1993-2001). Reporting sources for IRs and MRs differ.

Farin Kamangar. Patterns of Cancer Incidence, Mortality, and Prevalence Across Five Continents: Defining Priorities to
Disparities in Different Geographic Regions of the World. Journal of Clinical Oncology. 24:2137-2150. 2006

Screening mammography

- Important for early detection of breast carcinoma
- One important feature: microcalcifications on the mammogram
- However:
  - Difficult to identify by eye
  - Image often dark
  - Low-density or high density calcification flecks or high densely clustered calcifications



Microcalcifications?

- Small calcium deposits
- If they appear in a certain pattern and are clustered together, they may be a sign of precancerous cells or early breast cancer
- Two types of microcalcifications:

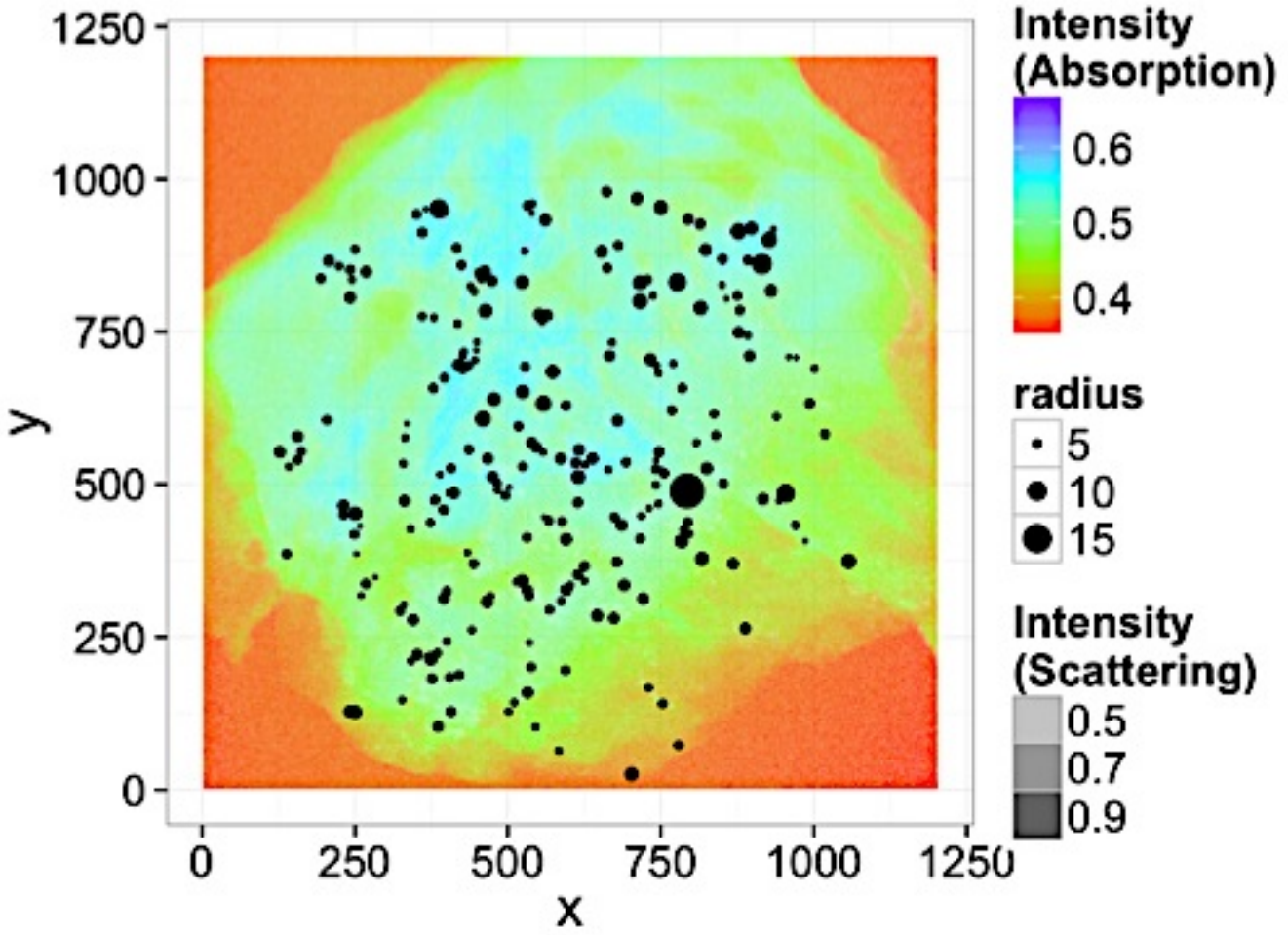
Type I :

- diagnosed as benign
- calcium oxalate dihydrate

Type II:

- benign or malign
- calcium phosphates (mainly calcium hydroxiapatite)

Identified calcifications (by hand)



Our goal

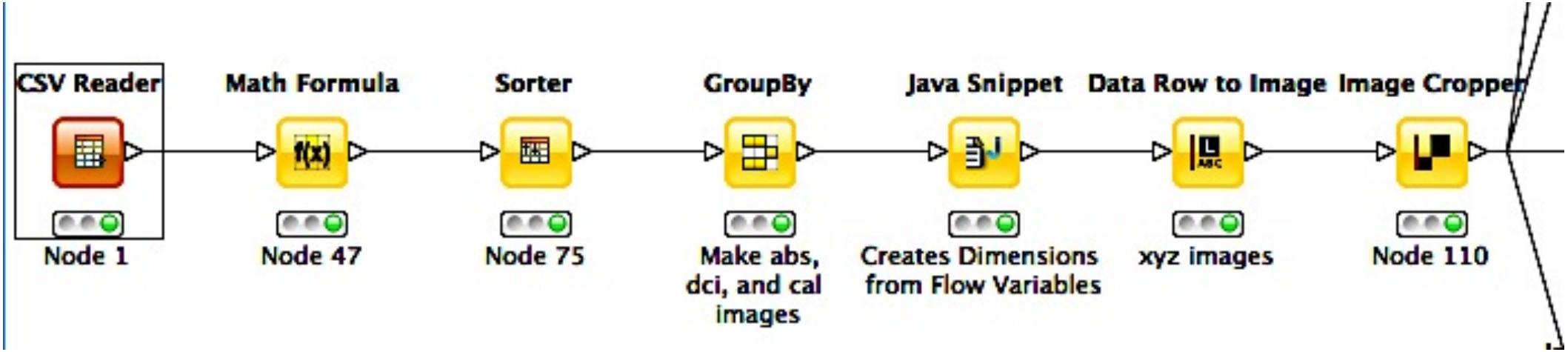
- Try to automatically detect the microcalcifications in a mammography

How?

- By setting up a workflow (knime) that processes and enhances the initial mammograph image

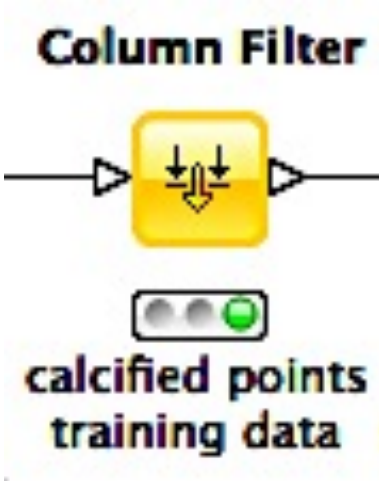
→ Ideally: implement this in a conventional mammograph machine to screen automatically for potential (malign) microcalcifications

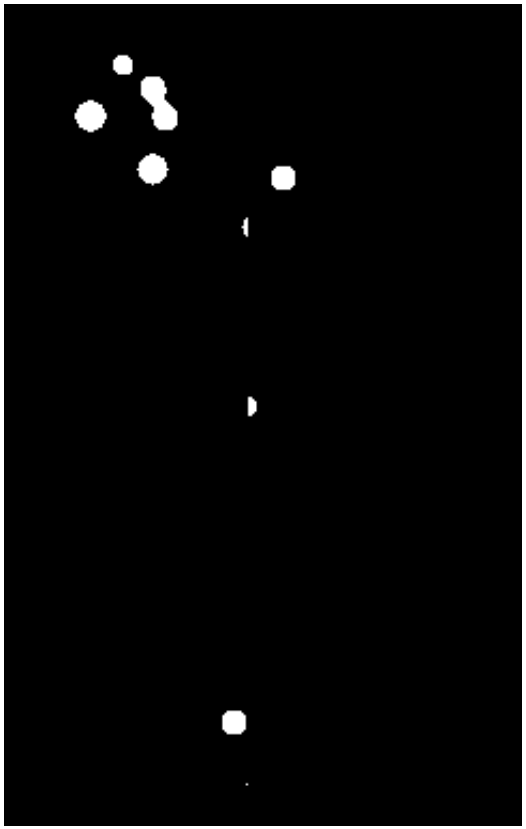
Workflow Inizialization



- Original data: table → Need to convert them into image.
- Cropping of a part of the image.

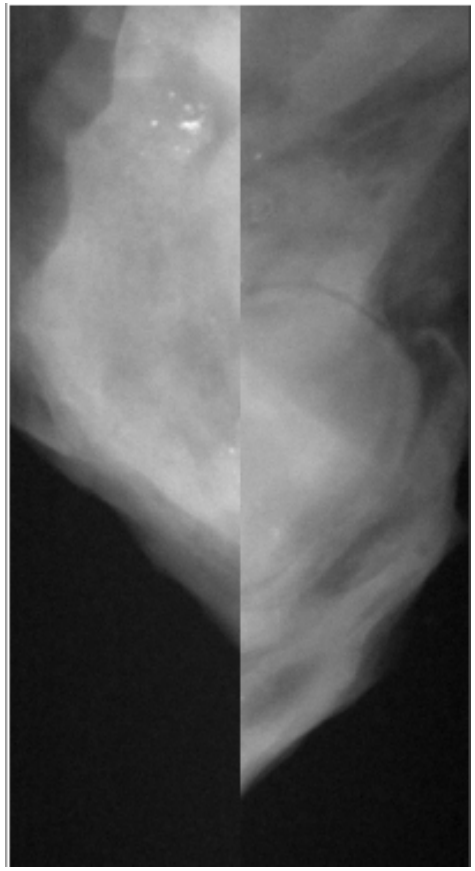
Column selection





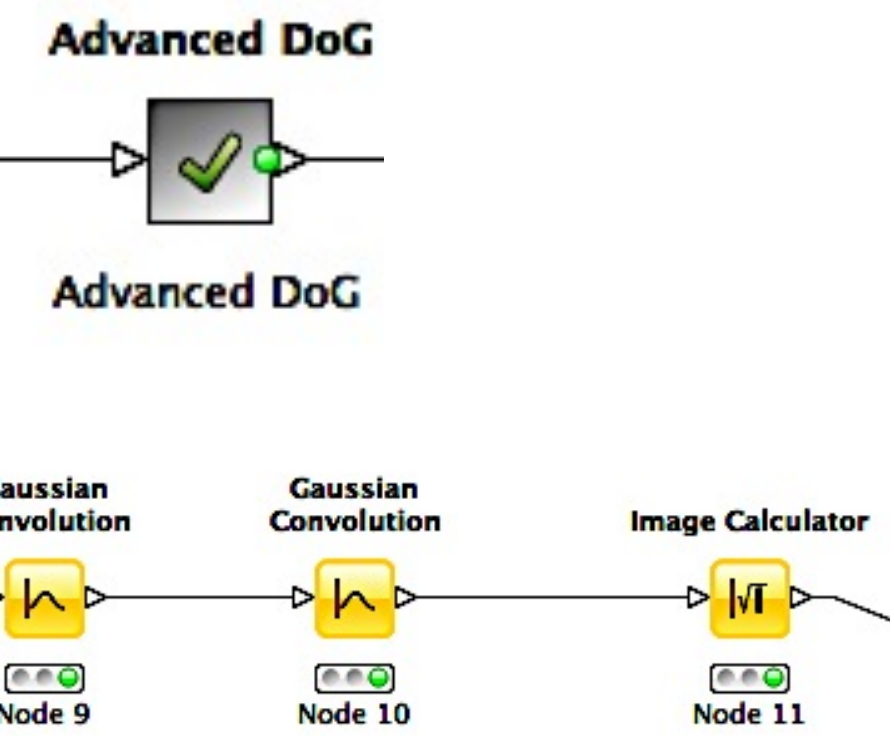
- Input data: absorption, scattering and manually labeled image.
- Separate analysis of the absorption and scattering → column selection using Column Filter.

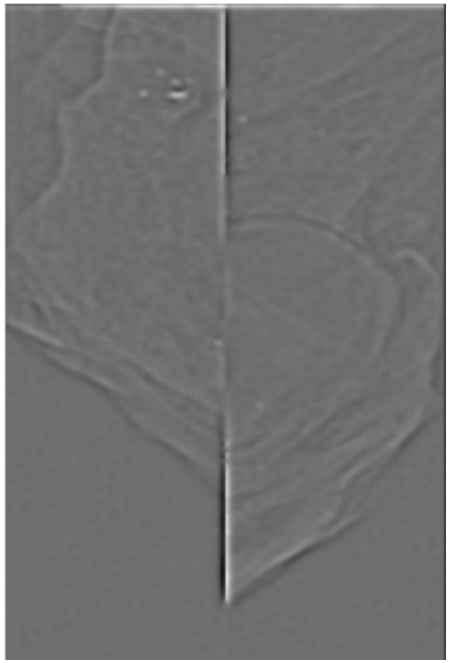
Image Enhancement



- Sigma filter: smooths the image performing an average over the neighboring pixels.
- Range defined by the standard deviation of the pixel values within the neighborhood.
- If neighborhood is chose within 1-2 sigma, the filter preserves edges better than a normal averaging filter.

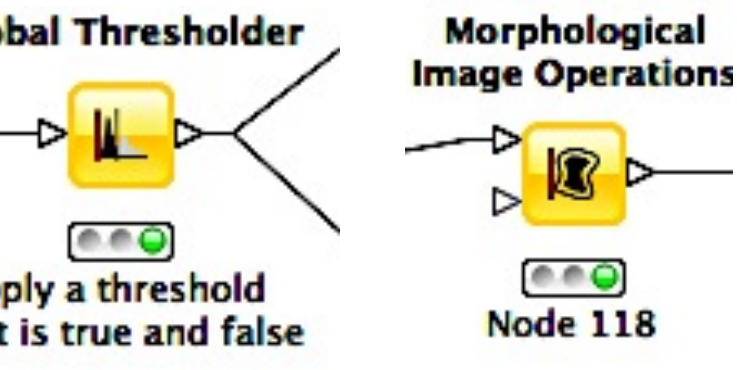
Image Enhancement





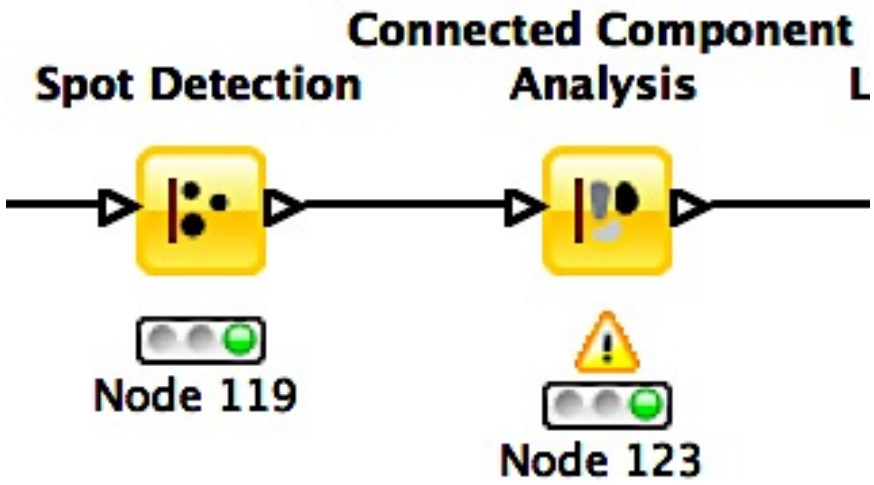
- Difference of Gaussian filter → band-pass which performs two separate Gaussian blur with different radii on the image and then substracts them.
- Parameters settings: works better if sigma2<sigma1.
- Purpose: edge detection.

Thresholding and Morphological Operations



- Manually setting of a threshold → distinguish background and foreground.
- Opening (1 iteration) → removal of some of the foreground pixels from the edges of foreground regions.

Spot detection and connected component analysis

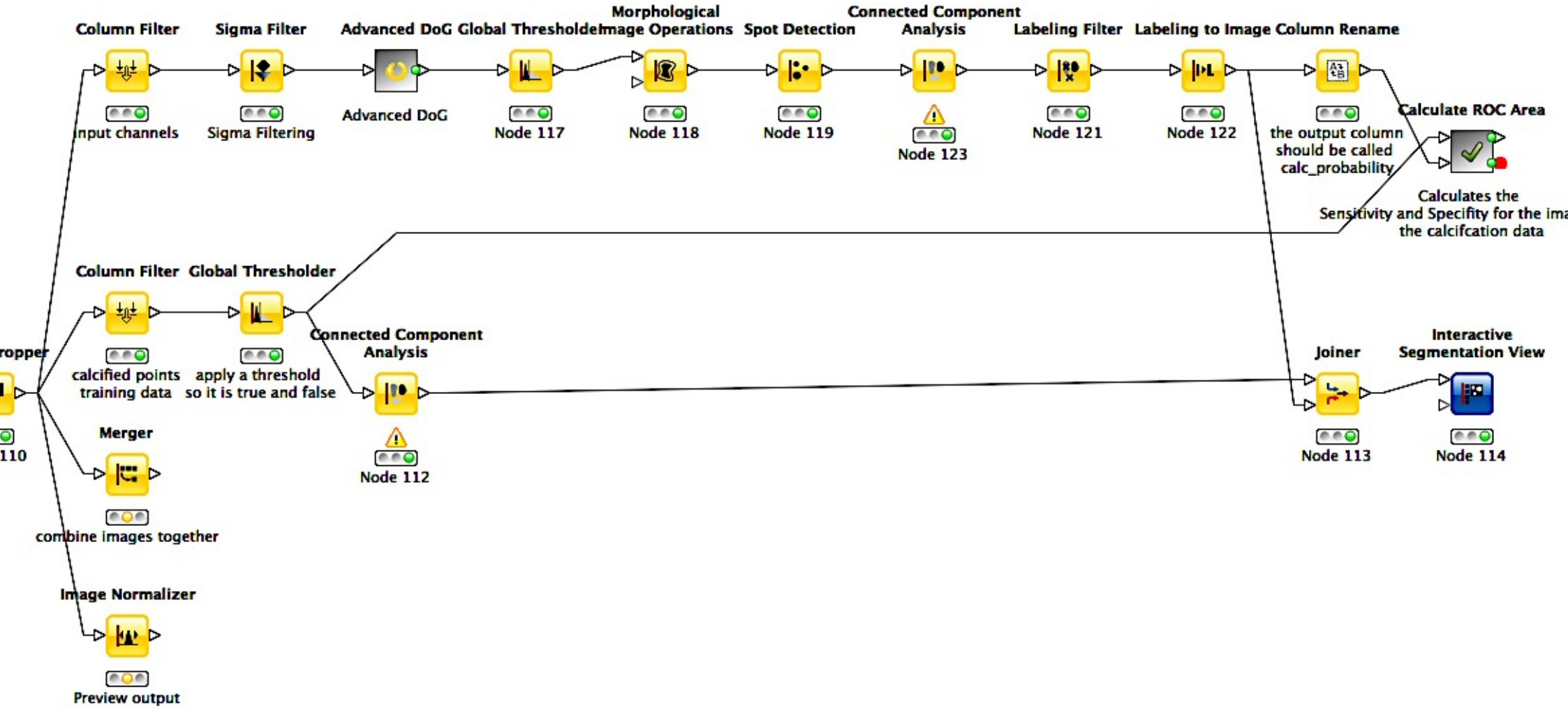


- Extraction of spots in biological images.

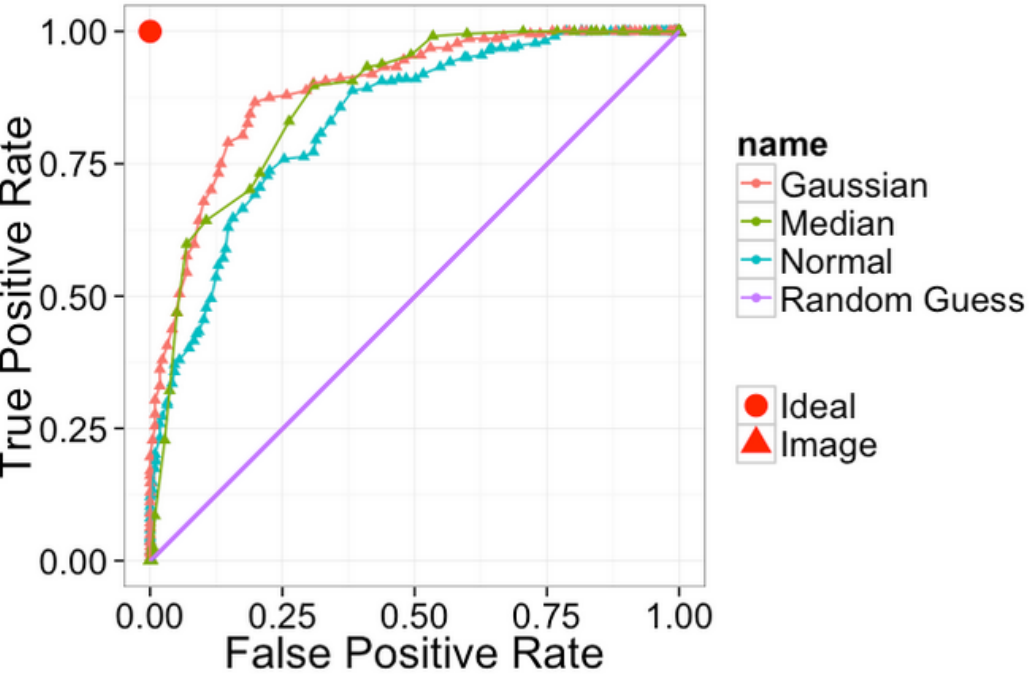
Size-based filtering

- Filtering of the objects on account of the size.
- Minimum segment area: 45
- Maximum segment area: 590

Final workflow



Results



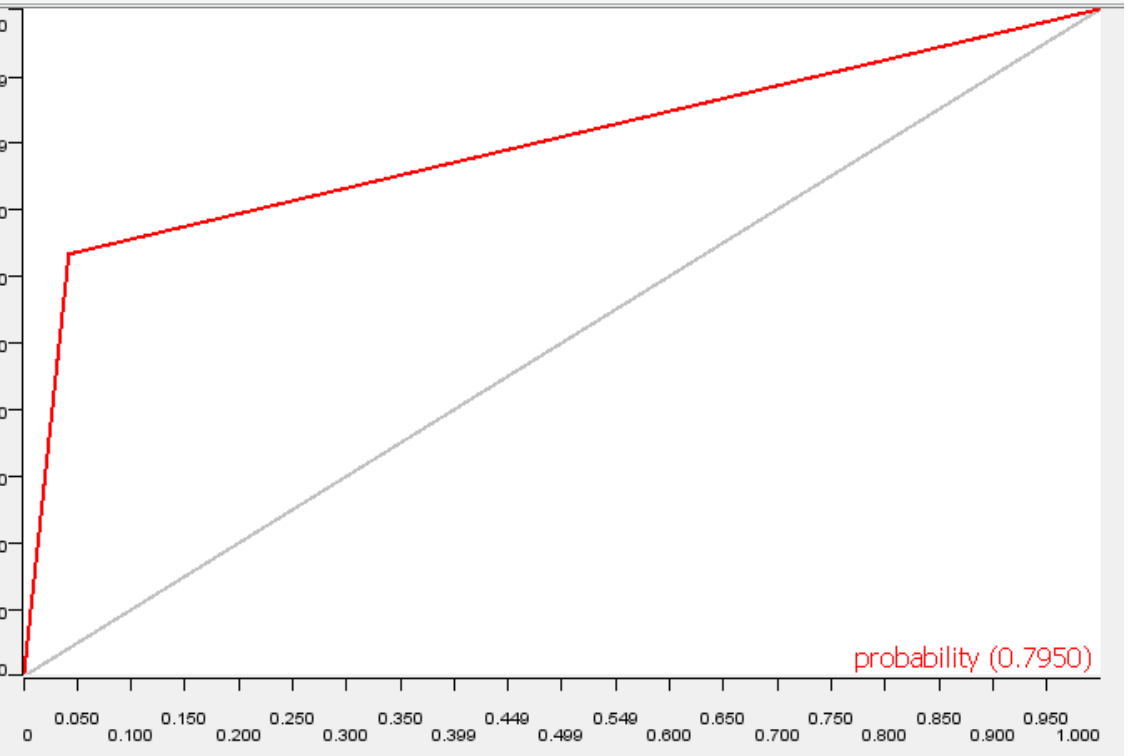
- ROC curve

True positive rate $= TP/TP+FN$

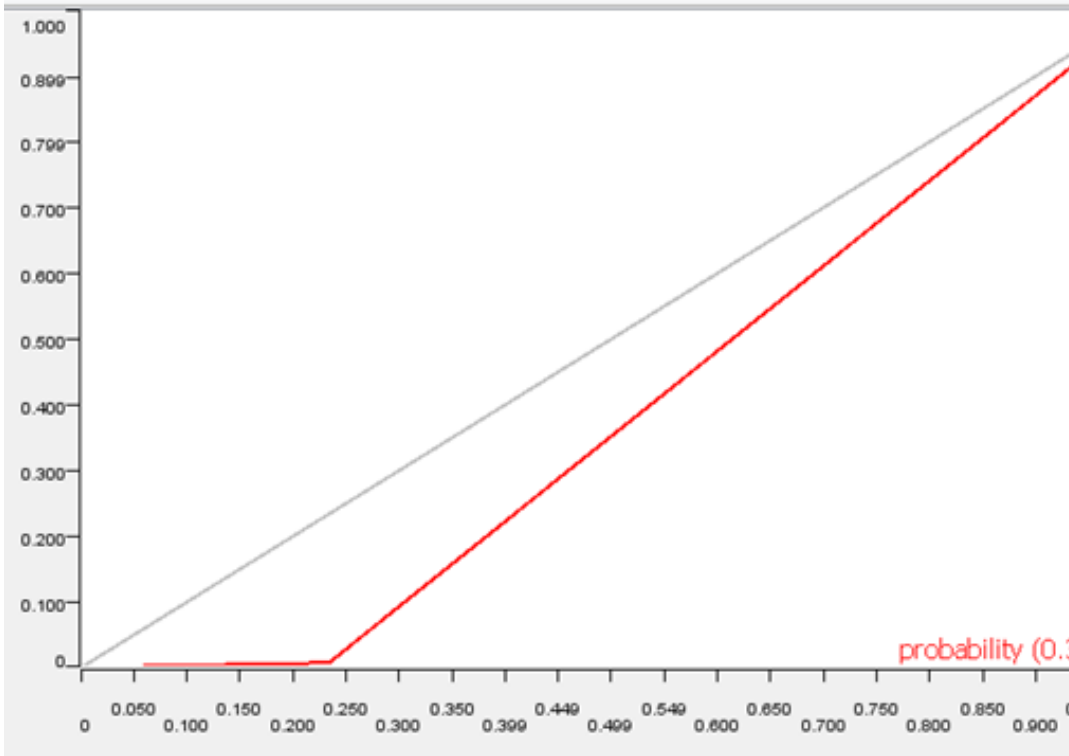
False positive rate $= TP/TP+FN$

Results of trial and error

- absorption

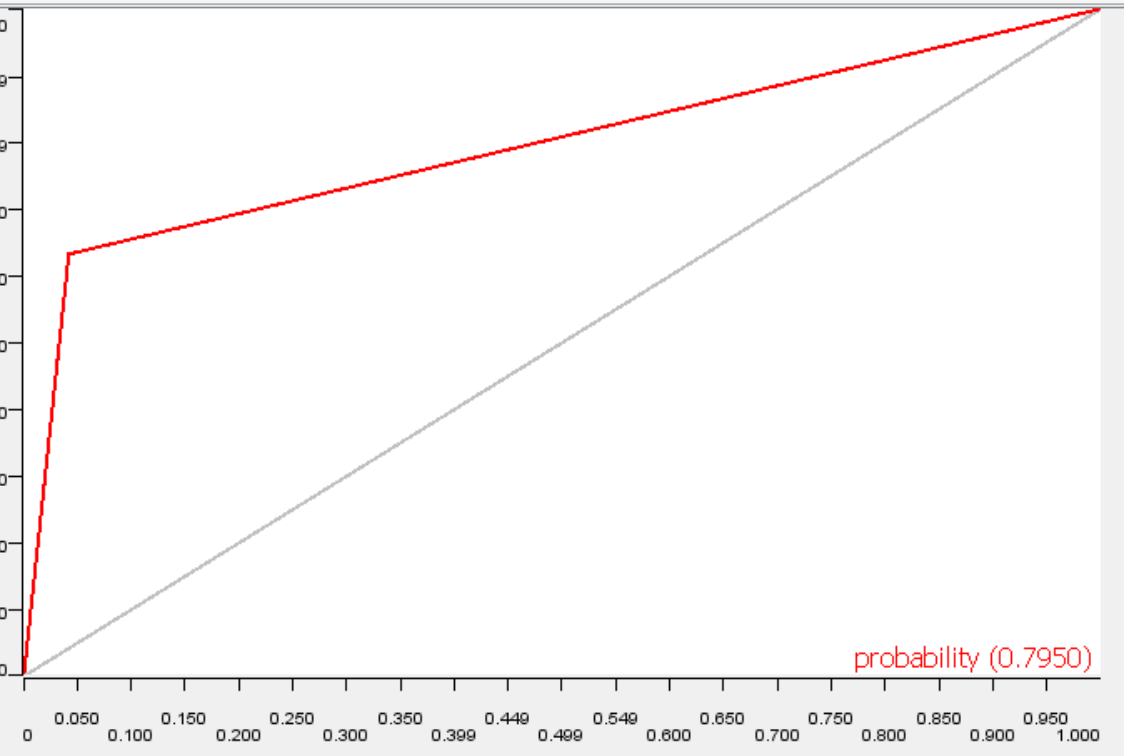


- scattering

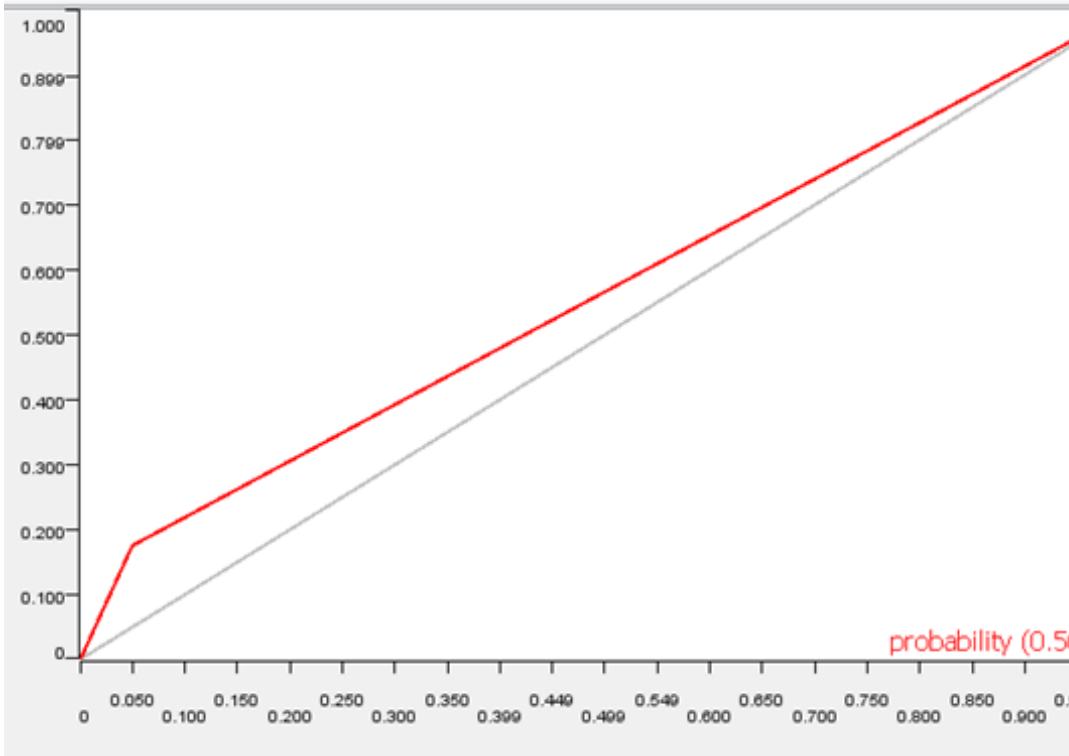


Results of trial and error

- absorption

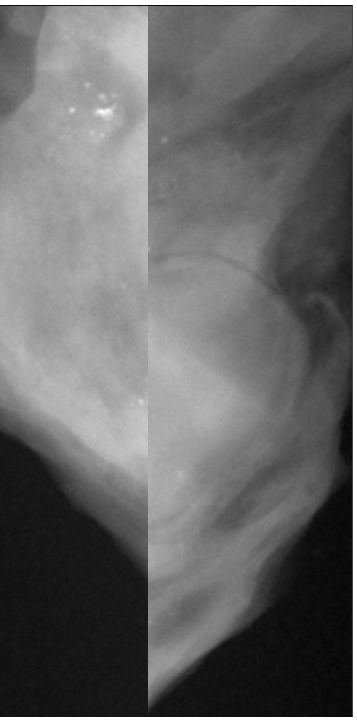


- scattering



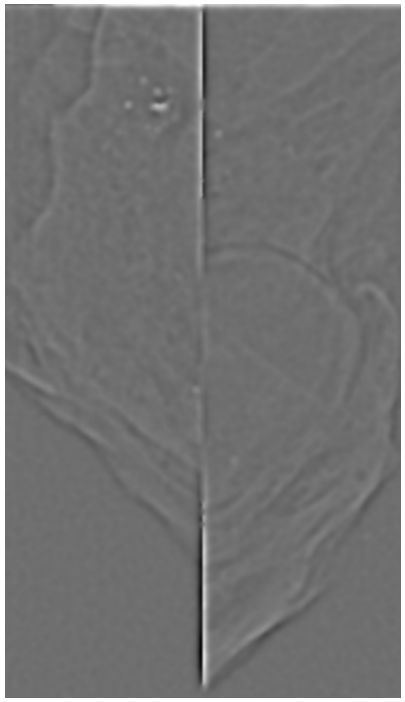
Data Row to Image

xyz images



Advanced DoG

Advanced DoG



Global Thresholder

Node 124

Connected Component Analysis

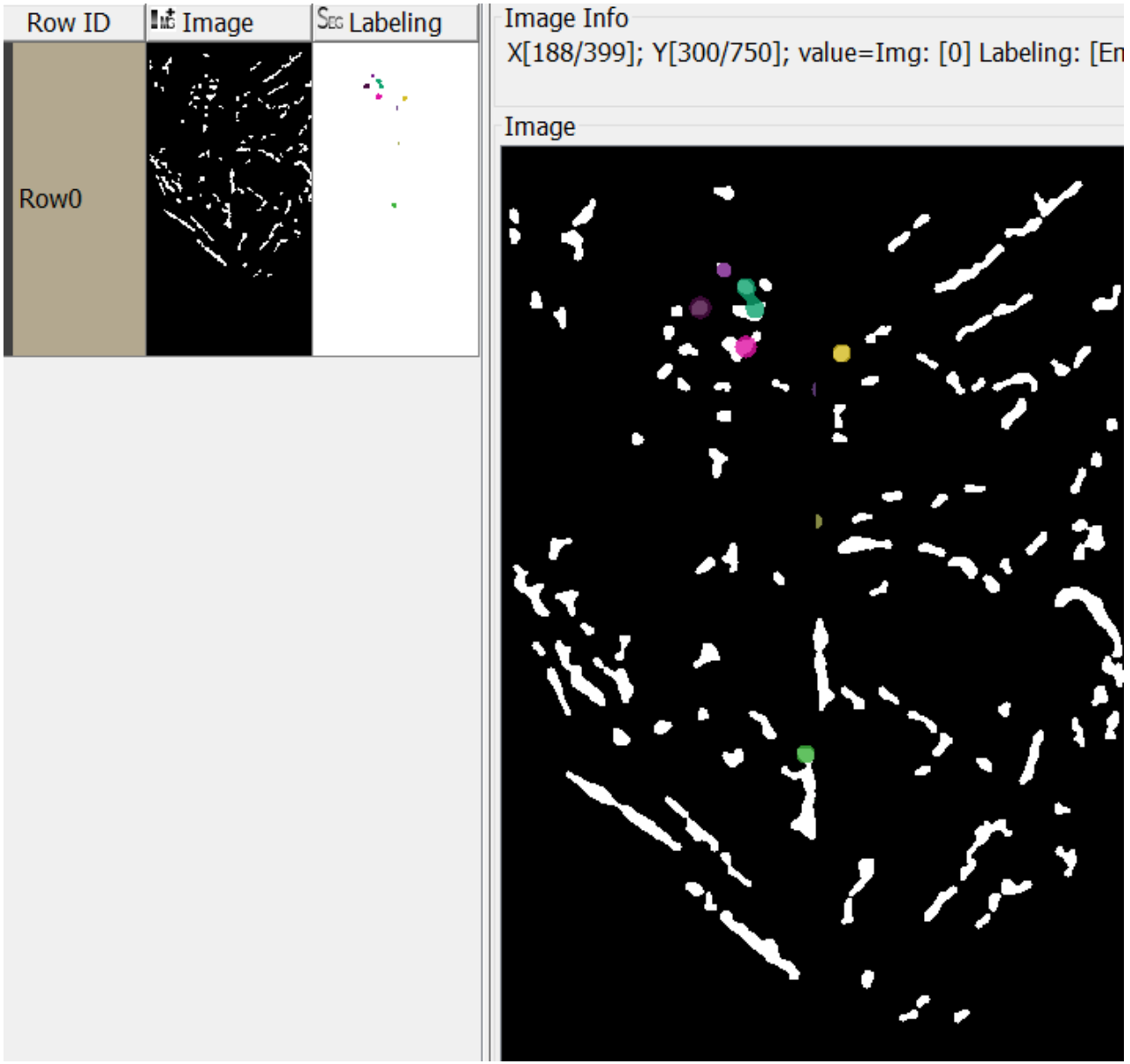
Node 127

Labeling Filter

Node 128

Interactive Segmentation View

Node 129

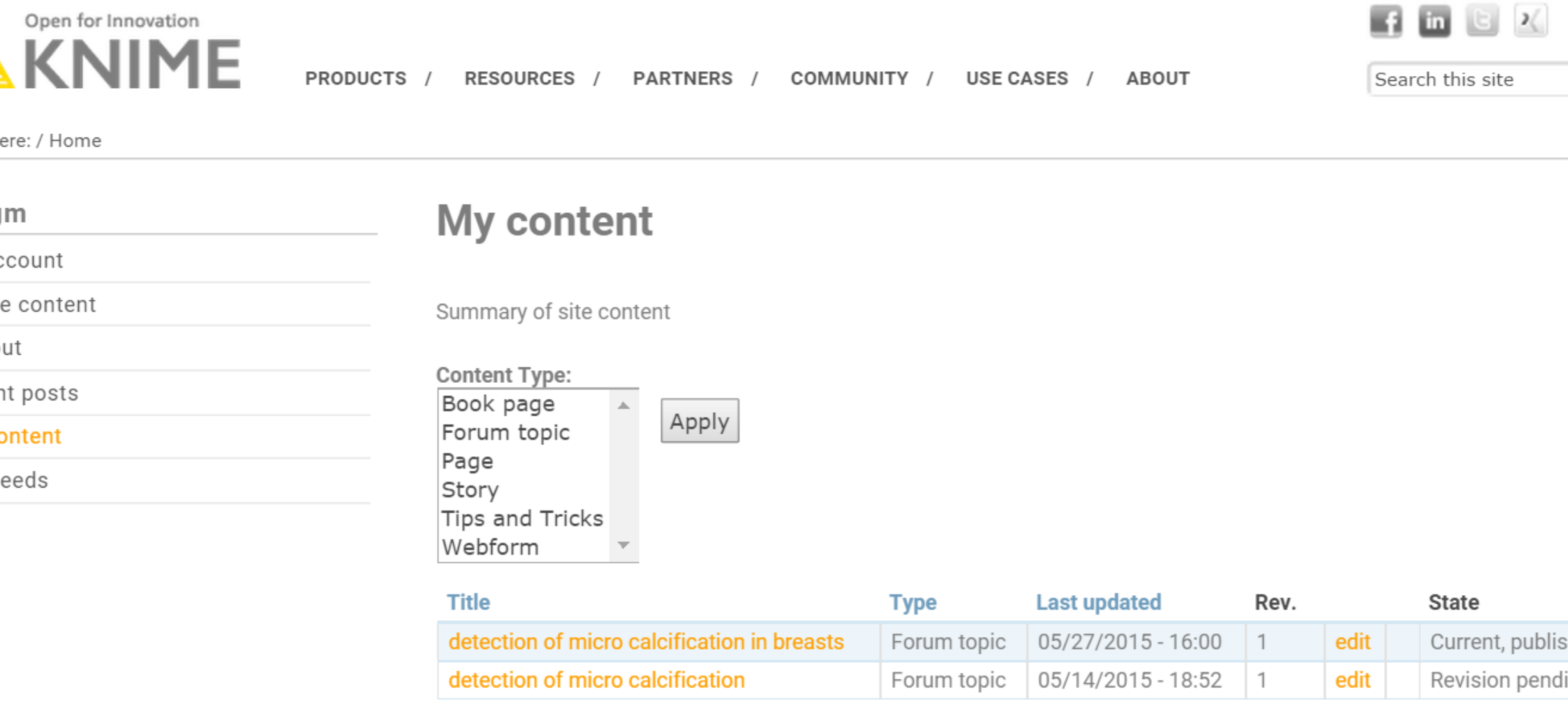


Next steps

- combination
  - scattering + absorption

- ask professionals

Next steps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Wed, 05/27/2015 - 20:36 #2

christian.dietz
Offline
Joined: 06/01/2011
Email

Hi Matthias, Vittoria and Federica,

I will have a look today or tomorrow and give you some hints ;-)

Have a nice evening,

Christian

Top

reply

Questions?