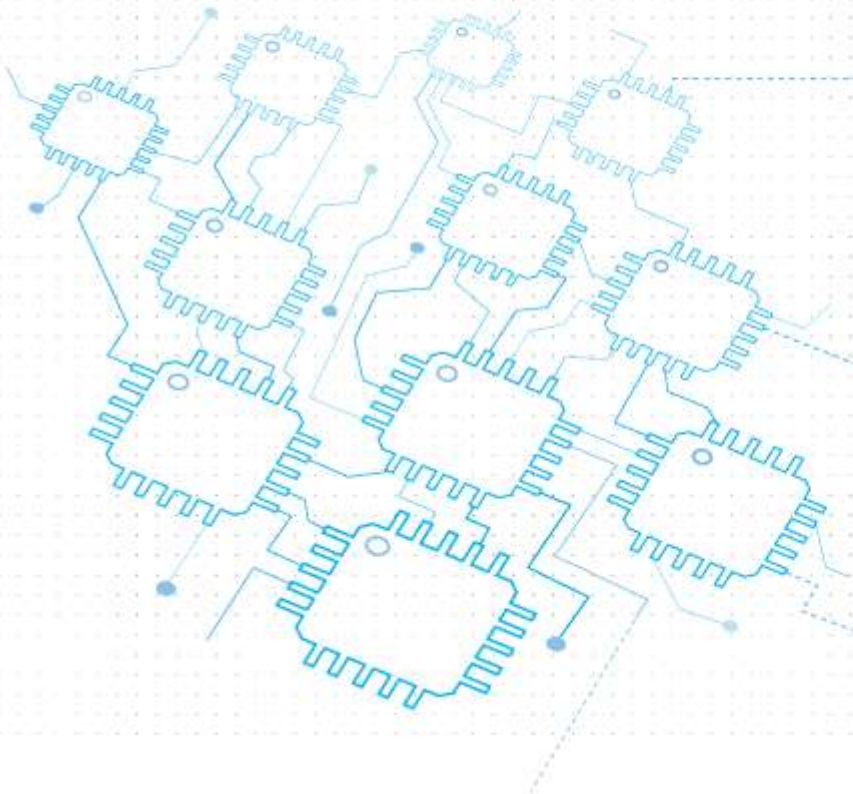
Academy of Sciences of the Czech Republic
Institute of Information Theory and Automation AS CR, v.v.i.



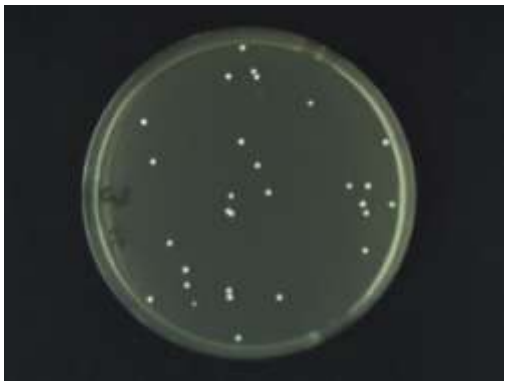
department of signal processing

Použití metod zpracování obrazu pro zpracování snímků kolonií kvasinek Saccharomyces cerevisiae.

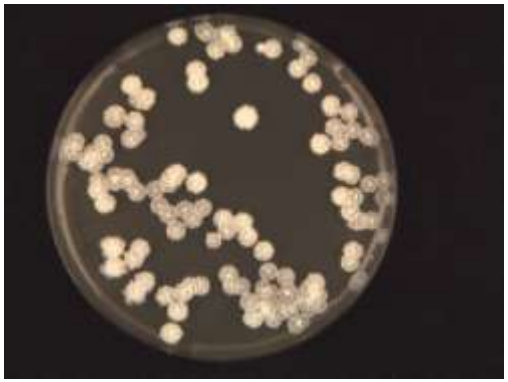
J. Schier
ÚTIA AV ČR, v.v.i.

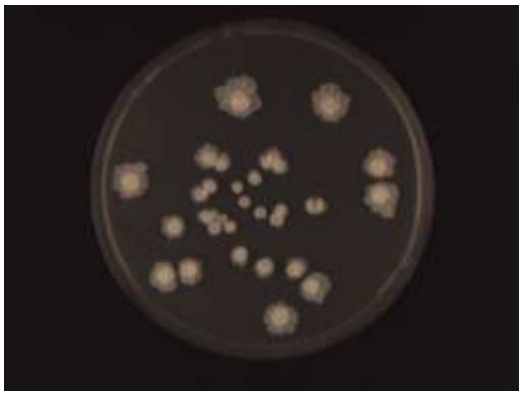
Examples images

“Nice” images



“Uggly” images





Analysis of colony growth

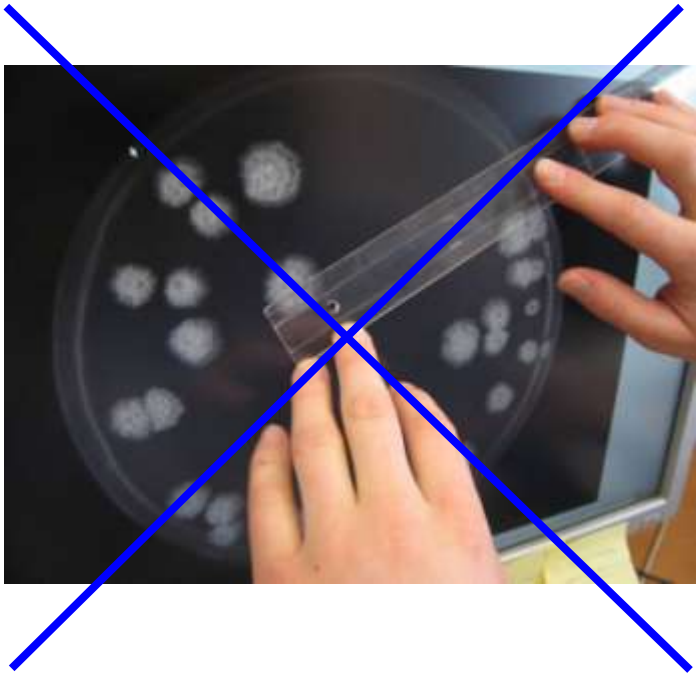
- Application area: microbiology
- Colonies innoculated on Petri dishes
- Testing influence of substance in the growth medium on innoculated colonies
- Growth box

  (constant temperature and humidity)
- Dishes sampled by digital camera

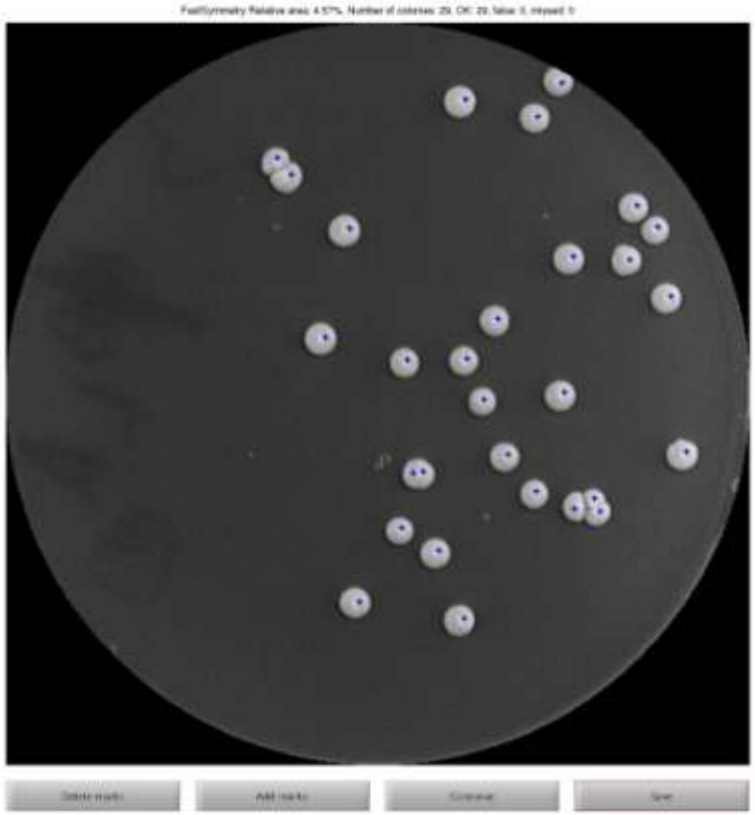
Growth box and imaging workplace

Quantitative analysis of images

- Area and number of colonies



Manual counting



Automated counting

Problems

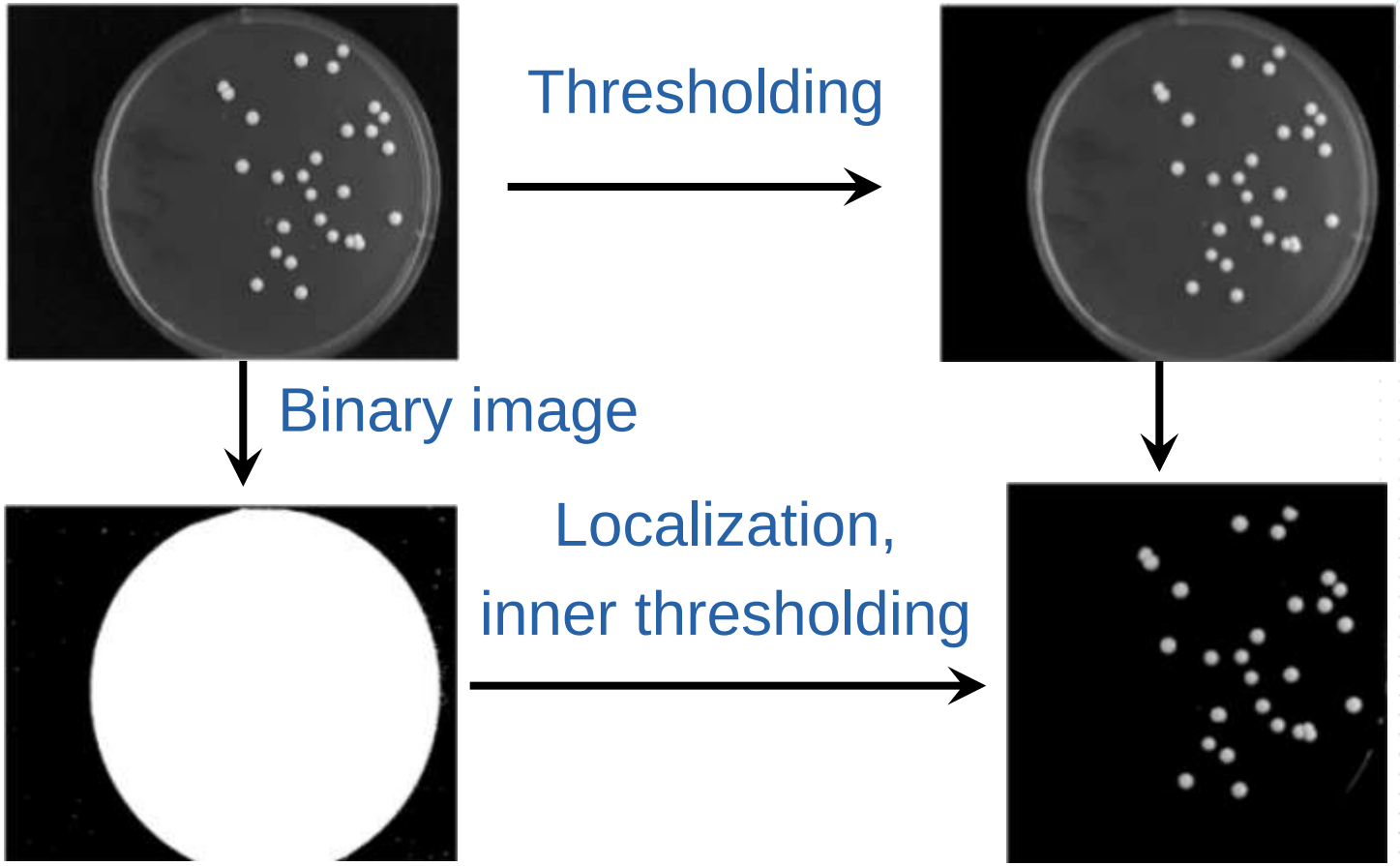
- Darkroom – controlled environment, but…

- Varying position of the dish
- Varying illumination, zoom setting

- Dispersion of colony size & morphology
- Colonies are often touching each other

Preprocessing

- Dish localization

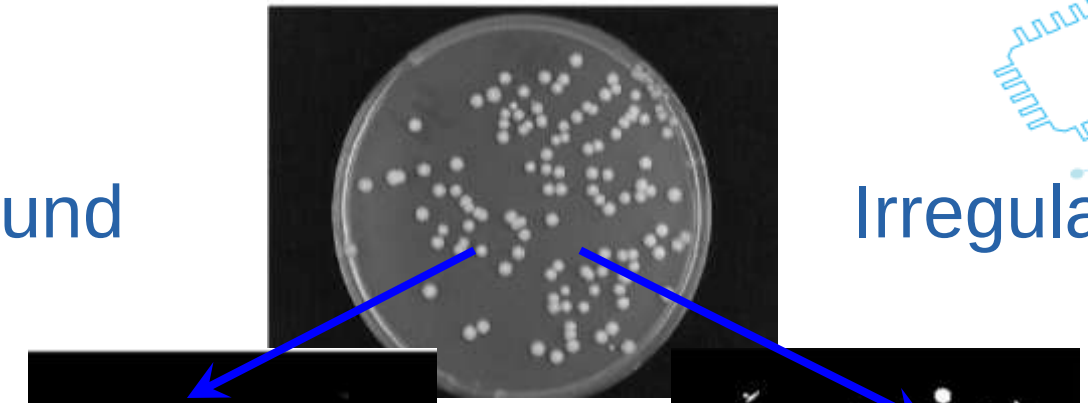


Counting methods

- Convolution method
  - based on convolution with circular pattern
- Fast Radial Symmetry

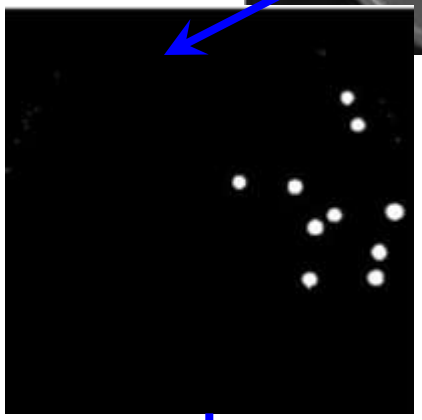
  (Loy&Zelinsky)
  - Orientation & magnitude image computed from gradient
- Both methods need estimate of colony radius

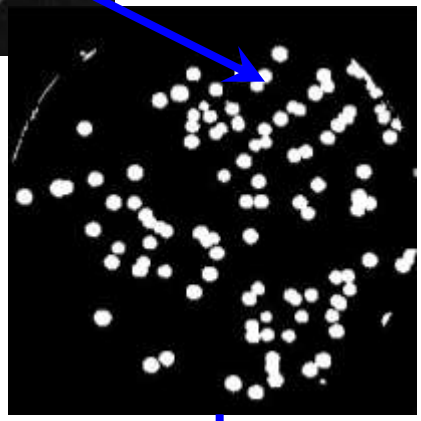
Radius estimation



Round

Irregular



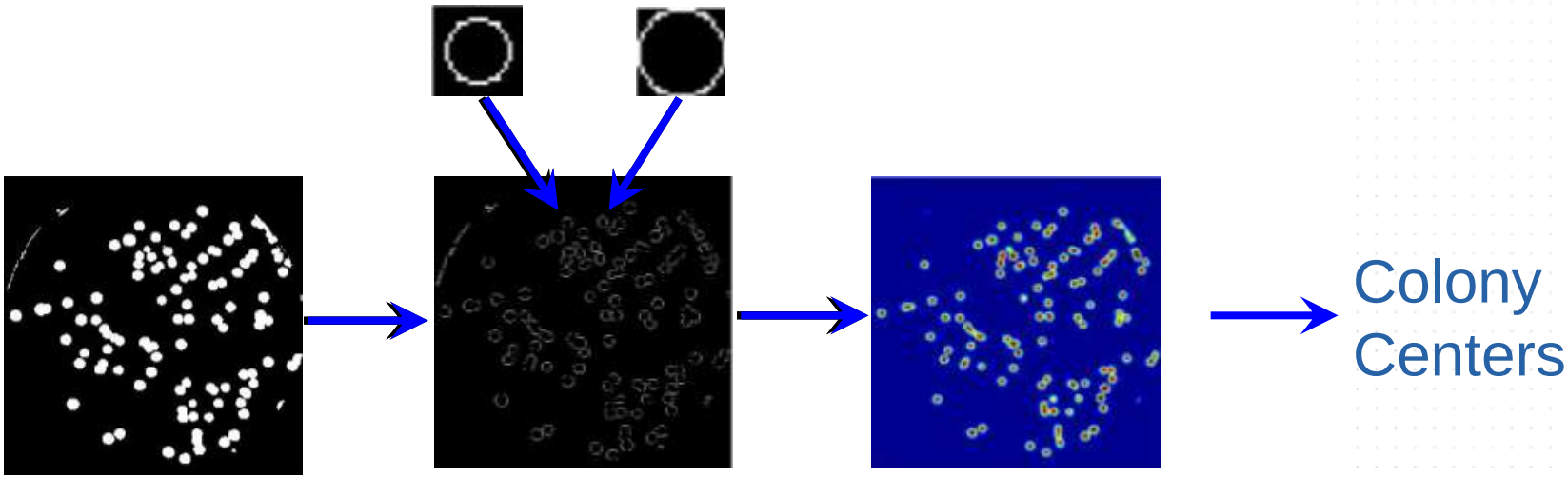


MinRadius, MaxRadius
radii=[.....]

Colony counting

Colony counting I

- Convolution method
  - radii vector→circular convolution patterns

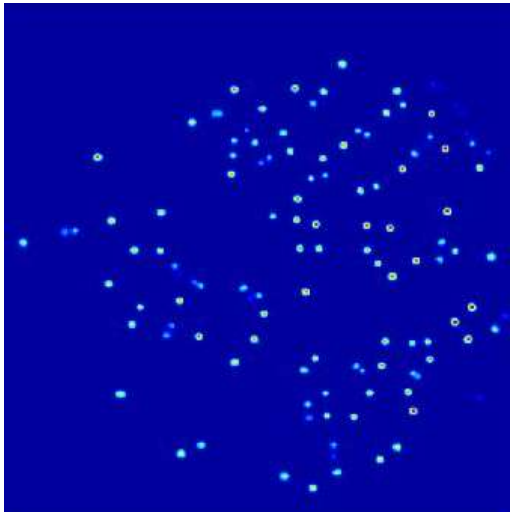


Colony counting II

- Fast radial transform

  (Loy&Zelinsky 2003)

  - Image gradient
  - Orientation and Magnitude Matrices
  - Result – symmetry matrix



Results

- 120 images evaluated
- Fast Radial Transform:
  - 82 images – no error
  - 106 images – all colonies detected
  - 113 images – max. 1 error
  - 92 images – no multiple or faulty detections
- Convolution:
  - 37 images – no error
  - 46 images - all colonies detected
  - 83 images – max. 1 error

Results - 2


24 images

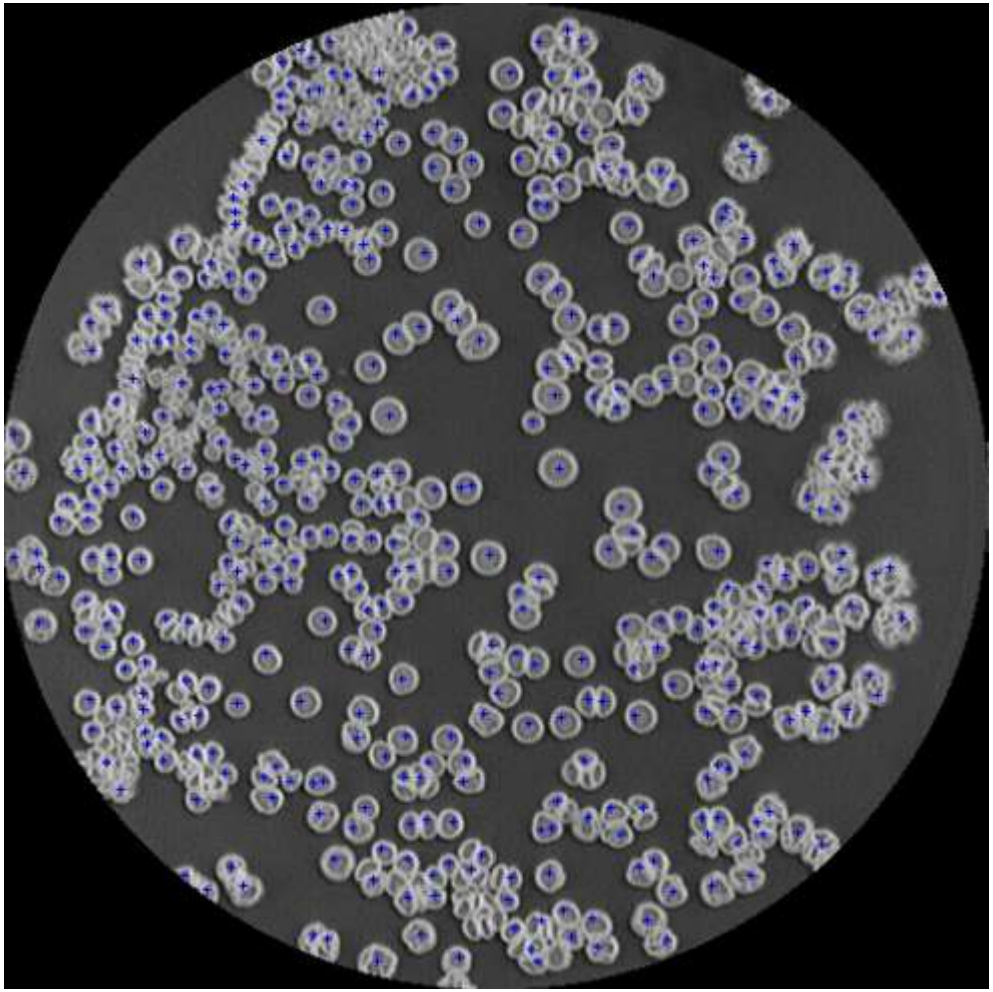

36 images


36 images


20 images

#Col.	Fast Radial Transform		Convolution	
	Missed	False	Missed	False
0-20	0.26	6.51	3.13	3.90
20-40	0.44	4.98	4.76	1.63
>40	0.24	2.12	14.62	0

Difficult example from the beginning…

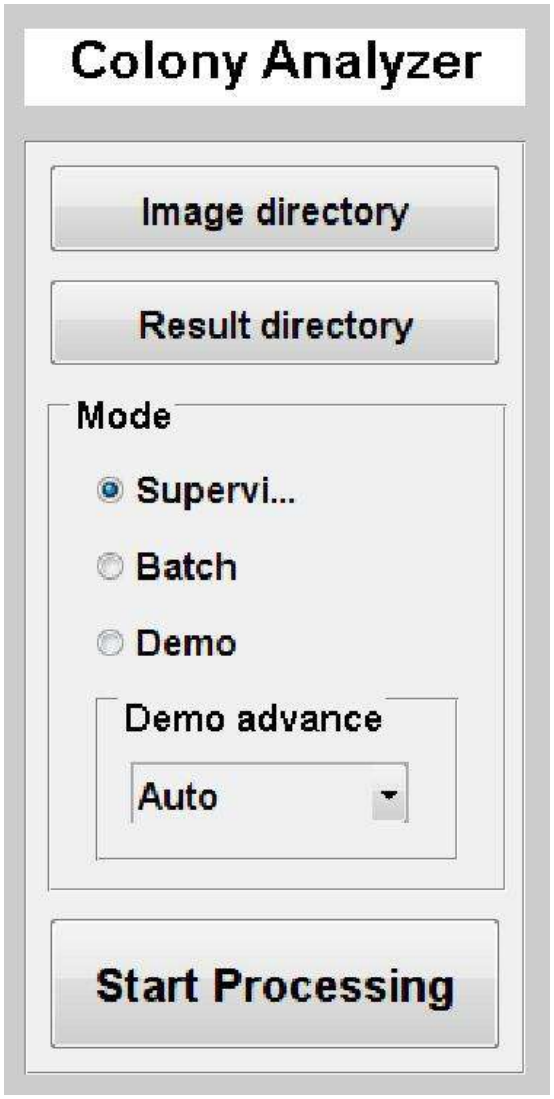


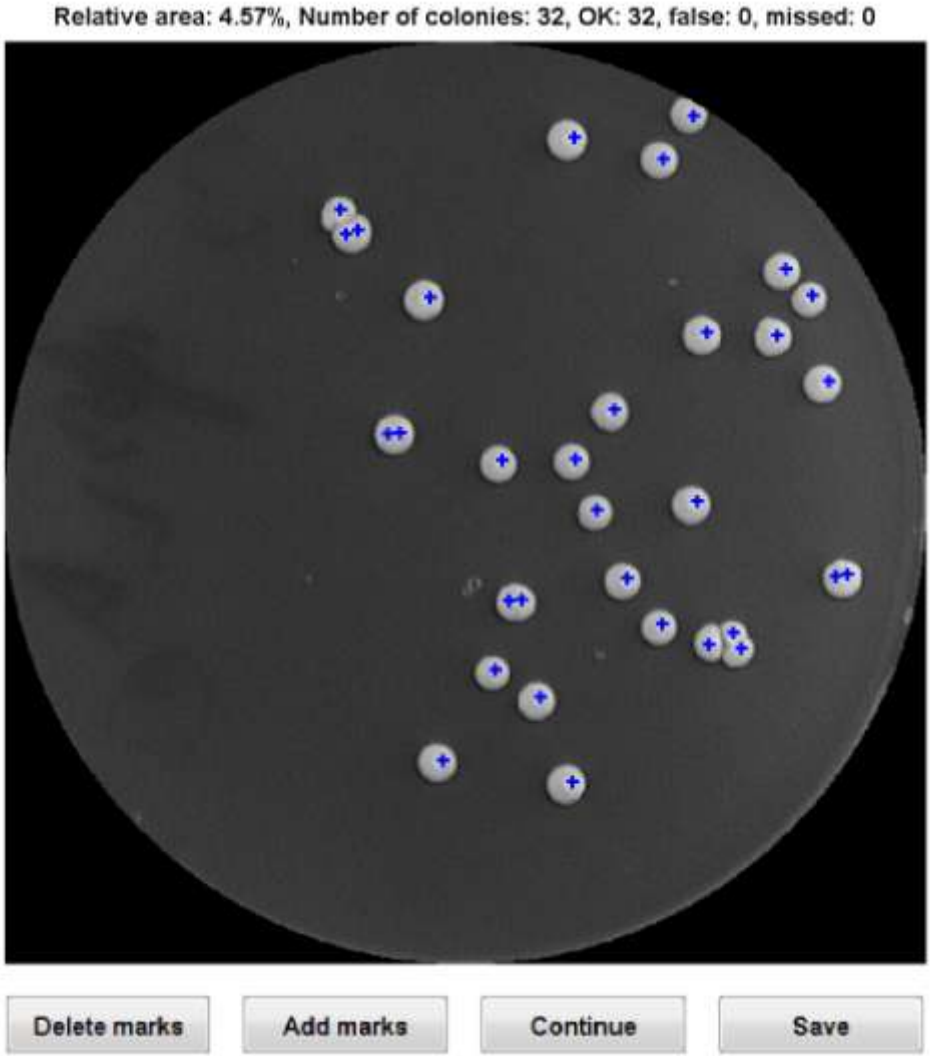
Result:

- Coverage 42.73%
- Total 598 colonies
- Detected 462
- Missed 136

(Fast Radial Symmetry)

Tool


Colony Analyzer
Image directory
Result directory
Mode
Supervi...
Batch
Demo
Demo advance
Auto
Start Processing


Relative area: 4.57%, Number of colonies: 32, OK: 32, false: 0, missed: 0
Delete marks
Add marks
Continue
Save

Conclusions

- Semi-automated processing of batches of Petri dish images
- Two methods proposed
- Interactive graphical editor of the result
- Evaluation of efficiency
- **Improved process over manual evaluation**
- **We would like to thank the Yeast Colony Group of the Facul**

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Acknowledgement

- We would like to thank the staff of the Yeast Colony Group, Faculty of Natural Sciences, Charles University, for the provided images of yeast colonies.