# 18-2264

# Automated Diagnosis of Prostate Cancer Location by Artificial Intelligence in multiparametric MRI
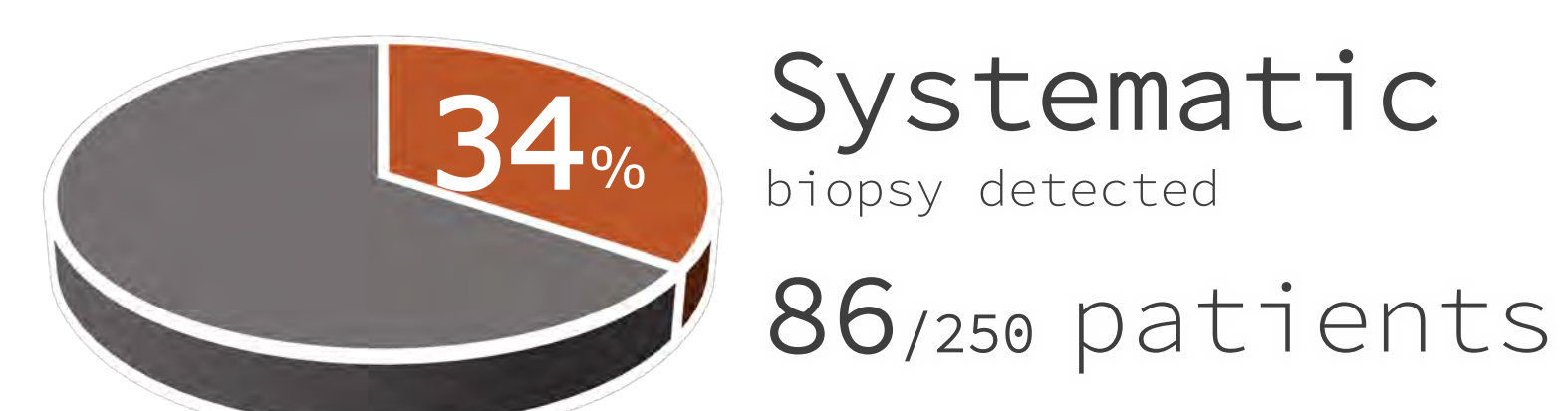
Y. Oishi[1)2)] T. Kitta[1)] N. Shinohara[1)] H. Nosato[2)] H. Sakanashi[2)] M. Murakawa[2)]

1) Department of Renal and Genitourinary Surgery, Hokkaido University, Sapporo, Japan
2) AI Research Center, National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan

## Introduction

Automatic PCa* localization enhances **prostate biopsy performance**

*
| | | | |
|---|---|---|---|
| PCa | Prostate cancer | mpMRI | Multiparametric MRI |
| RRP | Radical prostatectomy | SVM | Support vector machine |
| HLTI | Higer-order local texture information | | |

### Limitations in **systematic TRPB**
Lower cancer detection rate leads to repeat biopsy

**34%** Systematic biopsy detected 86/250 patients

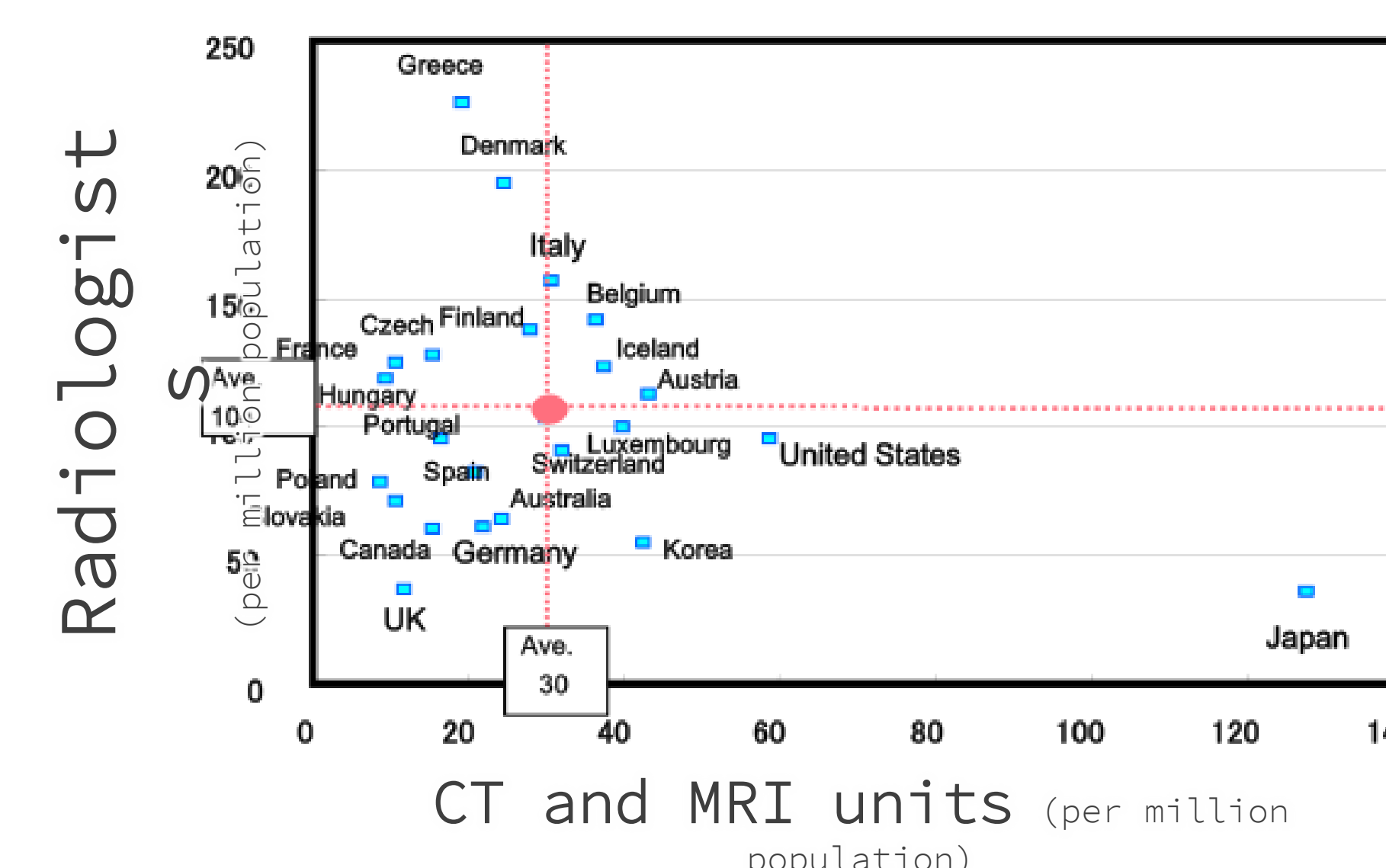**58%** Targeted biopsy detected 145/250 patients

■ PCa  ■ non PCa

-Int J Urol 2017

### Worldwide shortage of **Radiologists**
Especially in developed countries

US, Japan, Germany, UK, Canada and Australia `are bellow the average`

-Radiat Med 2008



## Purpose

**AI-based automatic PCa localization** on mpMRI*

## Materials and Methods

Primary SVM* converts MR images into **likelihood maps** describing cancer distribution.

Likelihood maps are segmented into cancerous or benign regions by **superpixel** method.

Secondary **SVM*** makes final diagnosis on each region according to texture and location feature.

### Dataset
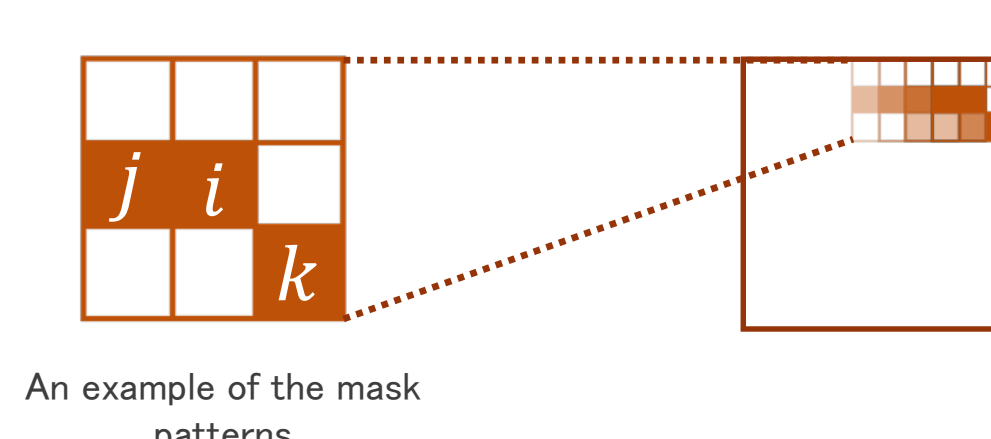Pre-biopsy **15** RRP* patients
**3T MRI** (Philips Japan)

T2WI    ADC    DWI
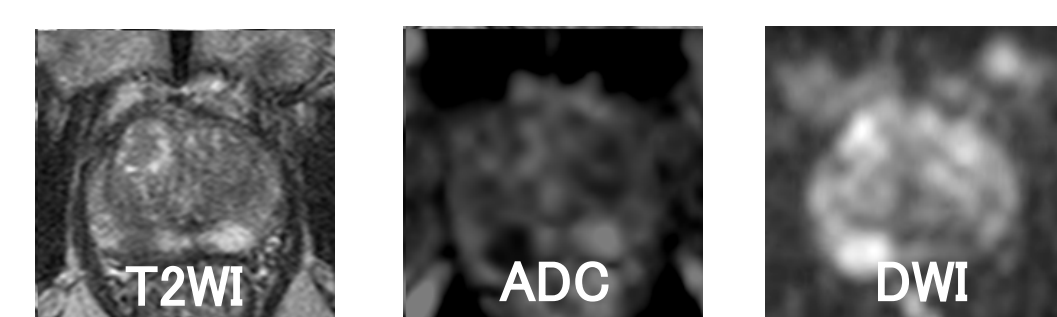
We focused on **PZ** diagnosis    Each sequence includes **94** DICOMs

### Feature Extraction
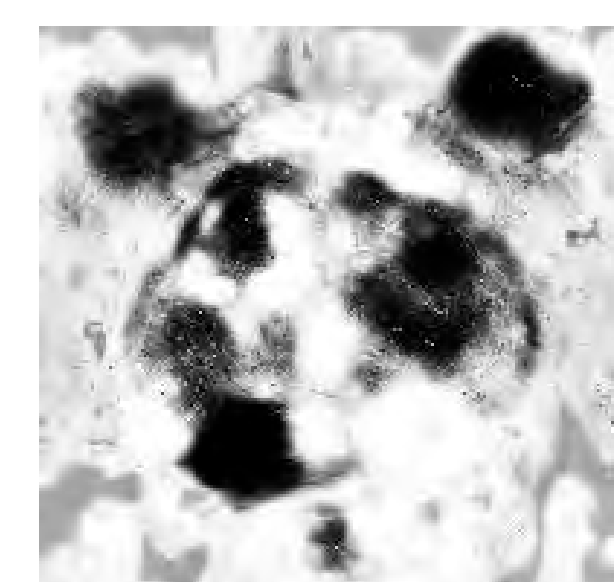An example of the mask patterns
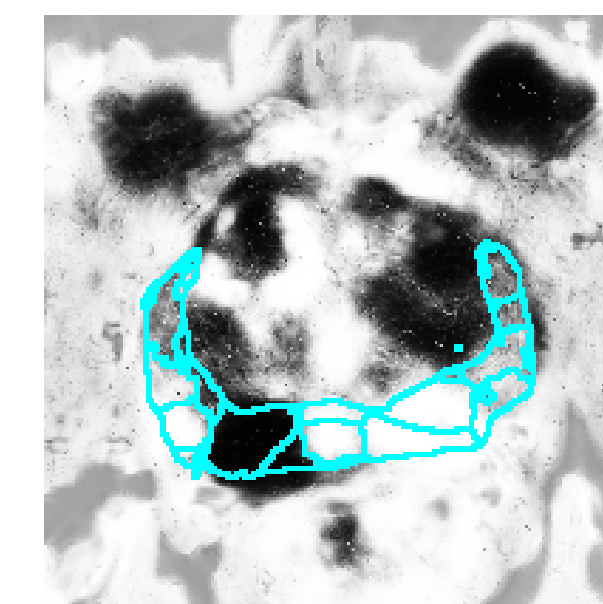**621** HLTI features on each pixel

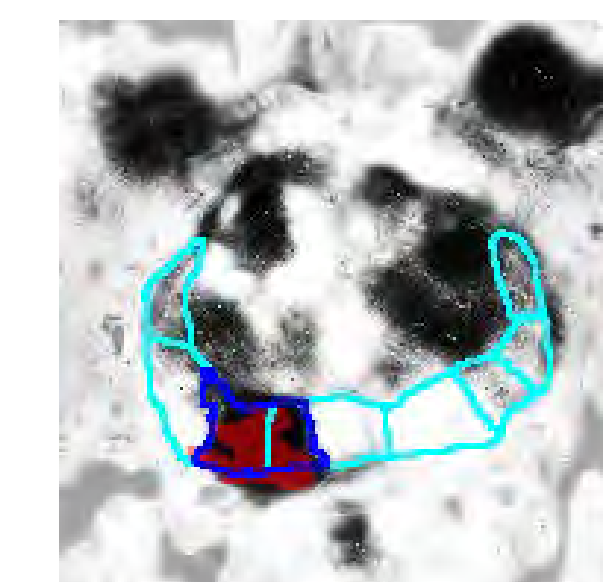Primary **SVM*** computation

### Likelihood Maps
Cancerous regions are shown as **dark area**.

### Superpixel Segmentation
Aggregating pixels with **similar pixel values**.

### Secondary SVM*
SVM diagnosis of each superpixel.

### Pixel-based **Cancer Labeling**
For training and validation
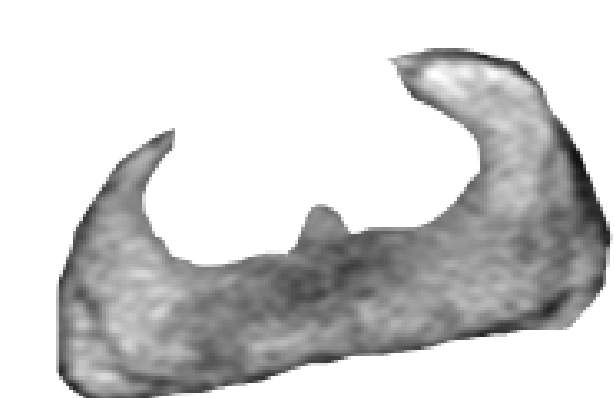
Manually extracted PZ
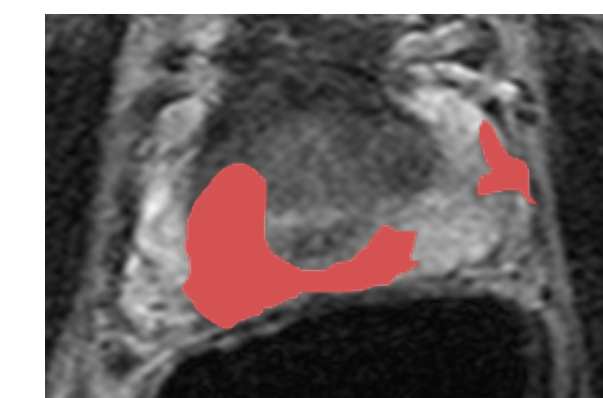
Manually labeled **cancer regions** according to **pathological mappings**

→ Cancer PZ
→ Benign PZ

### Leave one patient out **Cross Validation**

Changing test and training data by patient to avoid overfitting

Features Labels

**14** training set    training

SVM classifier    test

**1** Test set

Cancer likelihood or Cancer diagnosis

Change the combination of patients and evaluate each other

## Results — Area weighted evaluation
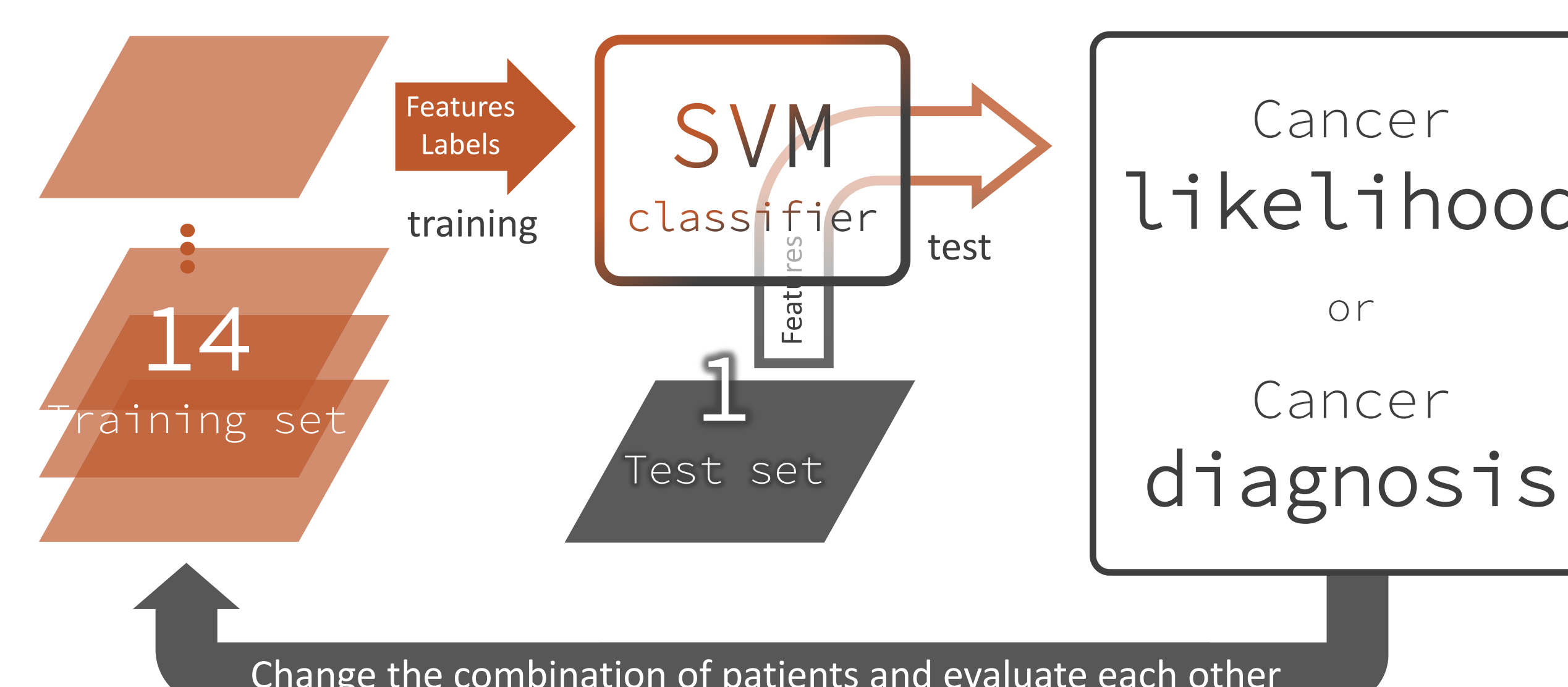
### Area weighted ROC curve

Sensitivity **93.8 %**
Specificity **96.3 %**
(*p*<0.01)

AUC **0.980**

### Examples of **AI-diagnosis** (2 patients)



■ cancer
■ AI-diagnosis
■ superpixels

## Conclusion

Combination of the **two AI-based techniques**,

**SVM*** likelihood map and **Superpixel** method,

is successfully applied to automatic PCa* localization on mpMRI*.