



# Mapping Prostate Cancer from Multi-parametric MRI with Improved Predictive Models (20140287, Dr. Greg Metzger)

**IP Status:** Issued US Patent; **Application #:** 15/089,273

## Diagnosing and Monitoring Prostate Cancer using mpMRI Data

A computer-aided diagnostic (CAD) tool, based on a novel predictive model for cancer detection from quantitative multiparametric MRI (mpMRI) data, uses magnetic resonance images to identify key markers of prostate cancer to aid in diagnosing and monitoring prostate cancer. The method, validated on histological prostate cancer tissue, requires the implementation of a multi-parametric MRI study consisting of multiple echo time fast spin echo acquisitions, dynamic contrast enhanced MRI, diffusion weighted imaging at multiple diffusion weightings (b-values), and gradient echo acquisitions at different flip angles. The software automatically processes datasets into a composite biomarker that detects cancerous tissue on a voxel-wise basis and generates pixel-wise maps of disease likelihood, using quantitative measures, to:

- reduce incidence of false negative biopsies, incorporating instead more active surveillance (i.e., decision to not biopsy)
- help direct biopsies and improve accuracy of biopsy procedure targets to improve specificity and selectivity for subsequent interventions (e.g., ablation or MR-ultrasound systems)
- precisely target therapies to reduce comorbidities
- reduce radiologist time needed to analyze each MR scan (thus reducing costs)
- improve quality of patient care

## Overcomes PSA, DRE and TRUS Limitations

The current gold standard for prostate cancer screening, the prostate-specific antigen (PSA) test, results in many false positives and false negatives, and is unable to localize possible tumors or give information on the seriousness of the illness. Current standard for evaluating mpMRI data by way of Prostate Imaging Reporting and Data System are largely subjective using qualitative measures for disease identification and monitoring, and other current diagnostic tests (i.e., digital rectal exams (DRE), and trans-rectal ultrasound (TRUS) guided biopsy), do not provide the information needed to confidently diagnose and manage prostate cancer in an optimized, cost effective way. These limitations result in high numbers of unnecessary, untargeted, painful biopsies (e.g., "random" cores from partitioned sections), and grading based on cores that may not strongly indicate aggressiveness of tumors. This new mpMRI technology overcomes these limitations by way of a unique database of in vivo MRI and correlative pathology, and predictive models (composite biomarkers) for disease detection, grading (and eventually for assessing aggressiveness) on a voxel-by-voxel basis. Essentially, it offers improved models for imaging radiogenomics (i.e., the correlation between cancer imaging features and gene expression) that will improve or change the prostate cancer patient workflow. For example, the process could introduce MR imaging prior to biopsy for detection/grading and/or guidance for biopsy, reduce overtreatment, and improve targeting of therapy (e.g., brachytherapy, external-beam radiotherapy, etc.). Advantages over current approaches include improved performance in terms of overtreatment and under-staging, potential for improved detection, grading, and

## Technology ID

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## Category

Engineering & Physical Sciences/Instrumentation, Sensors & Controls  
Engineering & Physical Sciences/MRI & Spectroscopy  
Life Sciences/Diagnostics & Imaging  
Life Sciences/Human Health  
Life Sciences/Medical Devices  
Life Sciences/MRI & Spectroscopy  
Software & IT/Algorithms  
Agriculture &  
Veterinary/Veterinary Medicine

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therapy guidance (which may improve patient outcome and reduce healthcare costs), and voxel-by-voxel quantitative assessment without user intervention.

#### **BENEFITS AND FEATURES:**

- Quantitative mpMRI data
- Identifies key markers of prostate cancer
- Aids in diagnosing and monitoring prostate cancer
- Improves detection/grading
- May reduce number of false negative biopsies; may reduce overtreatment
- Helps direct biopsies and improve accuracy of biopsy procedure
- Improves quality of patient care
- Precisely targets therapies (e.g., brachytherapy, external-beam radiotherapy, etc.) to reduce comorbidities
- Reduces radiologist time needed to analyze each MR scan (thus reducing costs)
- Voxel-by-voxel quantitative assessment without user intervention

#### **APPLICATIONS:**

- Prostate cancer diagnostics
- All stages of prostate cancer management and treatment
- Directing biopsies, improving accuracy of biopsy
- Imaging the extent or growth of the cancer
- Confirming success of surgery or other treatments
- Monitoring prostate cancer without physician intervention
- Computer-aided cancer detection system
- SW as a service for detection/grading
- MRI/ultrasound fusion system or MR scanner
- Standalone computer aided detection software suite or accompaniment to magnetic resonance scanners

**Phase of Development** - Prototype developed

#### **Researchers**

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#### **Publications**

[\*Registration of in vivo prostate MRI and pseudo-whole mount histology using Local Affine Transformations guided by Internal Structures \(LATIS\)\*](#)

*Journal of Magnetic Resonance Imaging*, Volume 41, Issue 4, April 2015, pages 1104-1114

[\*Development of Multigene Expression Signature Maps at the Protein Level from Digitized Immunohistochemistry Slides\*](#)

*PLOS*, March 15, 2012

[\*Prostate cancer detection with multi-parametric MRI: Logistic regression analysis of quantitative T2, diffusion-weighted imaging, and dynamic contrast-enhanced MRI\*](#)

*Journal of Magnetic Resonance Imaging*, Volume 30, Issue 2, August 2009, pages 127-134

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