Stochastic Covariance Functions for Understanding the Histology and Improving Detection in Solid Tumors

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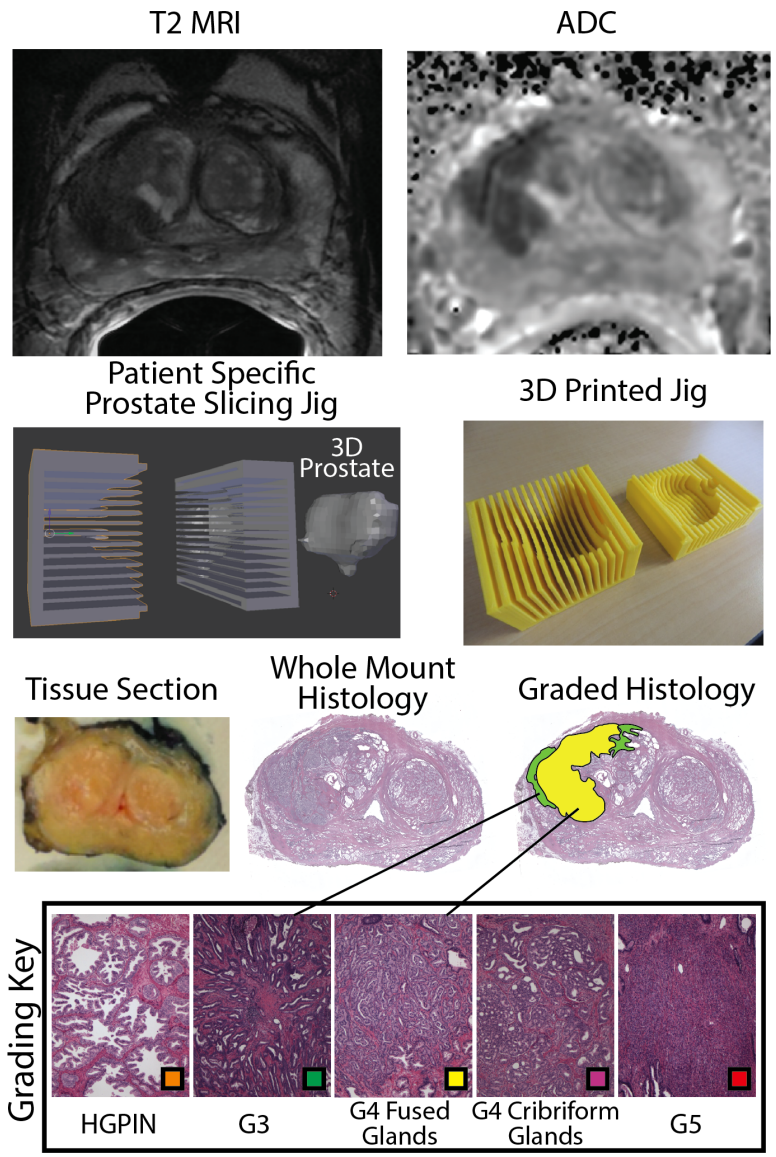
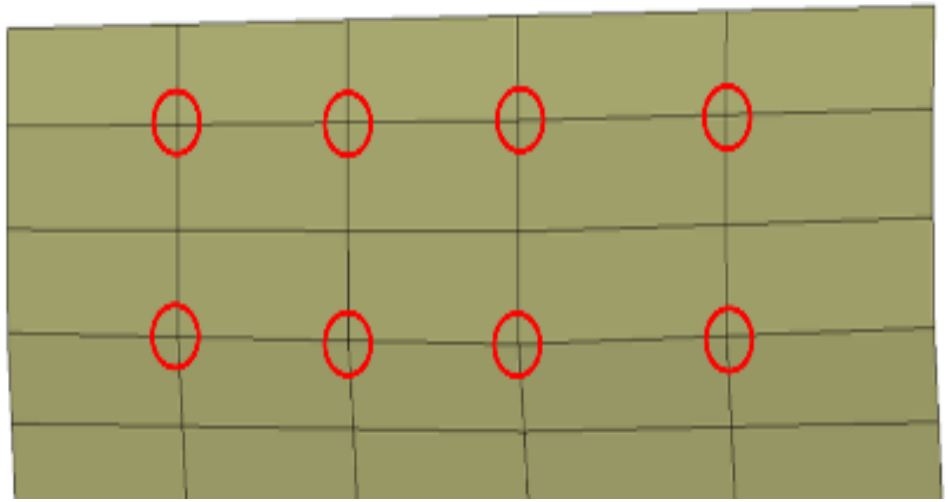
What, why and how?

- What: Modeling surfaces and spatio-temporal dependence structures.
  - Histology
  - Radiology
- Why: Solid tumors are inherently heterogeneous.
- How: Using hierarchical dictionaries.

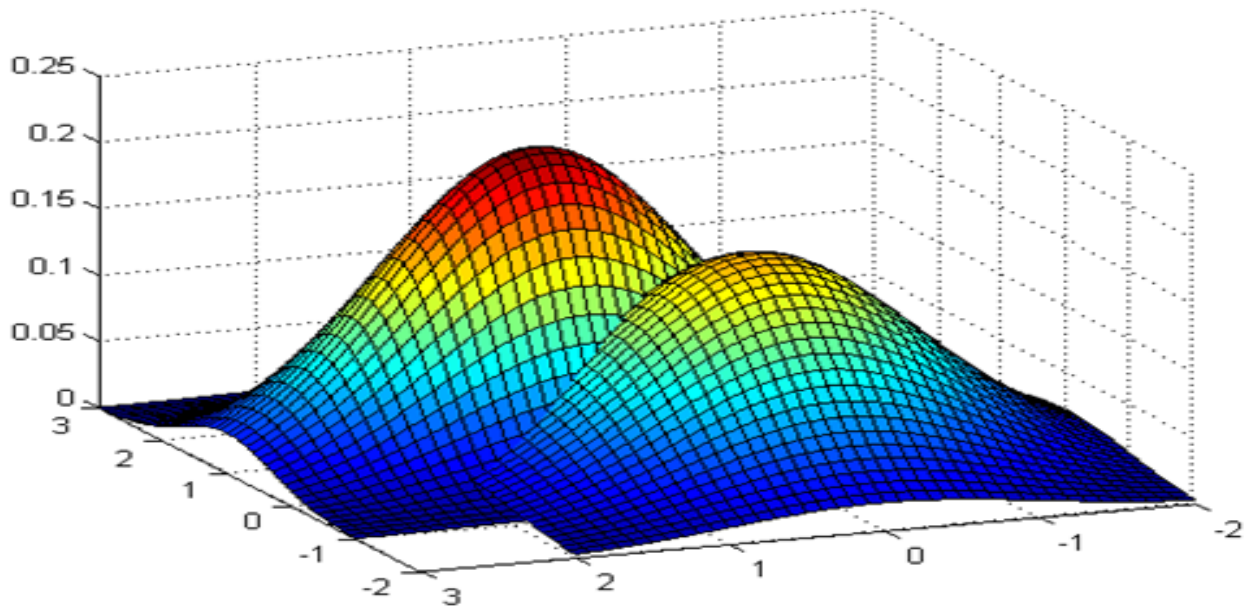


McGarry et al. International J. Rad. Onc. Biology Physics, 2018

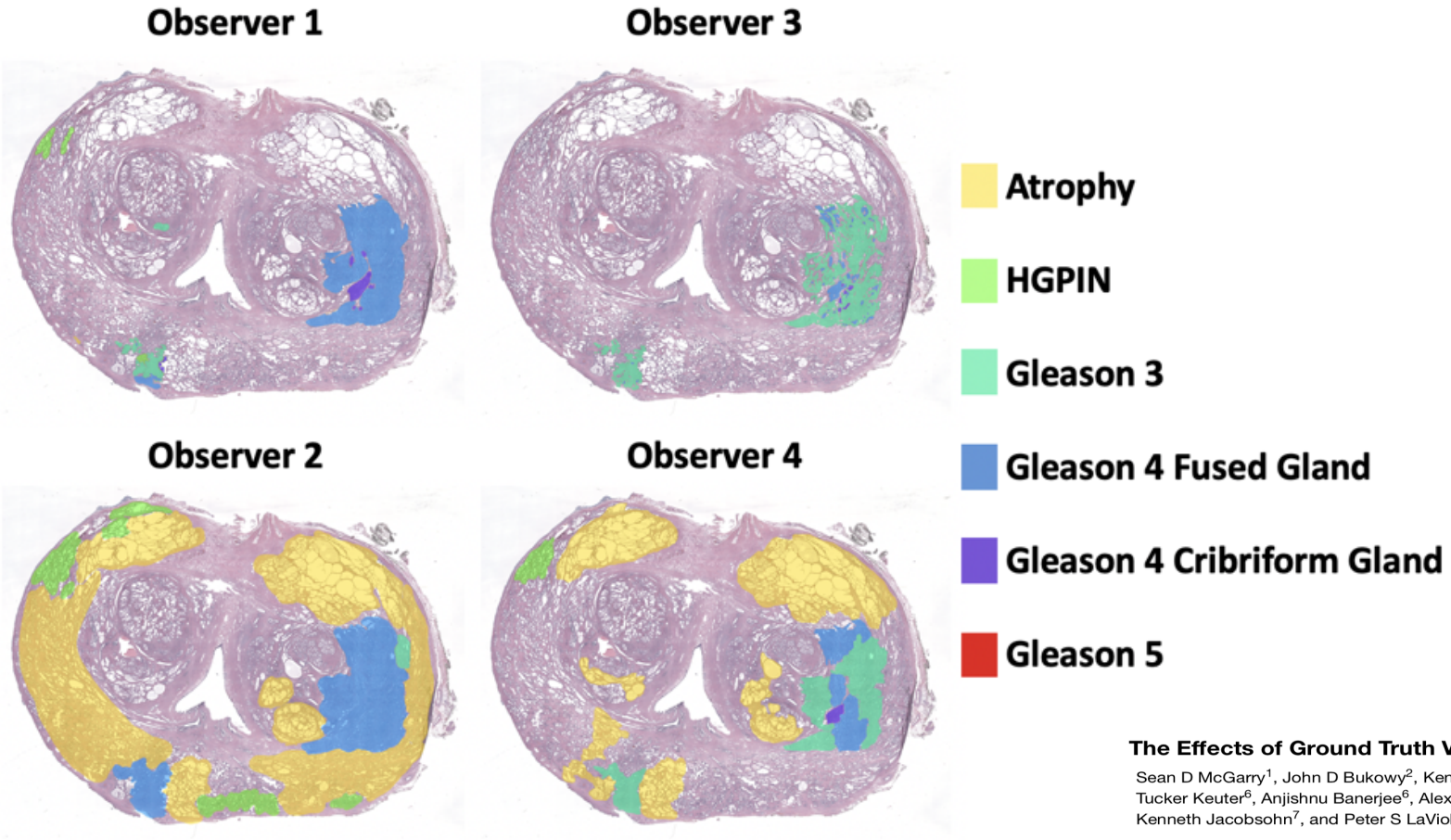
Covariance functions generation



Surface generation



Issues with the "Ground Truth"



The Effects of Ground Truth Variance on Radio-Pathomic Mapping in Prostate Cancer

Sean D McGarry[1], John D Bukowy[2], Kenneth A Iczkowski[3], Wei Huang[4], Tatjana Antic[5], Gladell Paner[5], Allison K Lowman[2], Tucker Keuter[6], Anjishnu Banerjee[6], Alex Barrington[2], Samuel Bobholz[1], Petar Duvnjak[2], Michael Griffin[2], Mark Hohenwalter[2], Kenneth Jacobsohn[7], and Peter S LaViolette[2]

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ISMRM 2019, Montreal

Robustness of findings: Knock-offs

- "Ground-truth" can be variable and oracle evaluation may not be feasible.
- Add "knock-off" that resemble existing data
- "Knock-off" metrics mimic actual observed data metrics
- Should help measure false discovery rates, etc …

Recent Success

- A Restricted Space-Filling Algorithm for Bayesian Learning with a Nearest Neighbor Gaussian Process (BLING)

Tucker K, McGarry SD, Lowman AK, Iczkowski KA, Jacobsohn K, Bukowy JD, Barrington AW, Hohenwalter M, See WA, LaViolette PS, Banerjee A.

In BNP @ NeurIPS [Dec 2018].

Summary and Funding acknowledgements

- Lots to investigate …
- My favorite quote, by Bill Watterson, C&H, “It’s a magical world, lets go exploring …”
- Questions?

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