

Notes from Oct 29, 2014 meeting

We want to relate observables to the 2D PDF of ψ_s :

$$(\alpha, \delta, e_1, e_2, \sigma_e) \rightarrow Pr(\psi_s) \quad (1)$$

Note that e_1 and e_2 are related to g_1, g_2 not γ_1, γ_2 directly.

Steps

0. generate Gaussian ψ
 - fit $\hat{\psi}$
1. Calculate γ, κ , from ψ
 - fit γ, κ
 - need to regularize Σ (covariance matrix) to ensure smoothness among other physical conditions

distance and metric

$r = \Delta x^T D^{-1} \Delta x$, where we have used a Euclidean metric D (to be consistent with Michael's notation),

$$D = \beta \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \quad (2)$$

with $\beta = -\frac{1}{4} \ln \rho$, but we can choose another metric later on.

details of step 0

$$\psi_s \sim GP(0, \Sigma), \quad (3)$$

where λ is called precision and ρ the correlation,

$$\Sigma = \Sigma(\lambda, \rho) \quad (4)$$

$$= \lambda^{-1} K(\rho) + I, \quad (5)$$

and we may want a Matérn covariance function, according to Michael,

$$K(\lambda, \rho) = \exp^{-\beta a(\Delta \alpha^2 + \Delta \delta^2)} \quad (6)$$

$$= \rho^{4a(\Delta \alpha^2 + \Delta \delta^2)}, \quad (7)$$

with $\rho \in [0, 1]$, Note: RA and DEC need to be in units of radians

Depending the degrees of freedom (d.o.f.) of the Matérn function, if $d.o.f \rightarrow \infty$, it's just a squared exponential kernel

$$K(l; s) = \exp\left(-\frac{s^2}{2l^2}\right) \quad (8)$$

with $s = \sqrt{\Delta\alpha^2 + \Delta\delta^2}$ and l is the characteristic length scale over which large fluctuation in the signal occurs. In our case, the characteristic length is: e :

$$l = \frac{1}{\sqrt{2a\beta}} = \sqrt{-\frac{2}{a \ln \rho}} \quad (9)$$

technical challenges

- come up with conditional update rule - make use of [Schur compliments](#)

steps 1

make use of the fact that γ and κ are derivatives of the scalar potential ψ_s :

$$\gamma_1, \gamma_2 \sim GP(0, \Sigma_{xx,yy}^\gamma(x, y)) \quad (10)$$

$$\kappa \sim GP(0, \Sigma_{xx,yy}^\kappa(x, y)) \quad (11)$$

eqns (8) and (9) are in the draft of the paper also.