Notes from Oct 29, 2014 meeting

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

$$(\alpha, \delta, e_1, e_2, \sigma_e) \to Pr(\psi_s) \tag{1}$$

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),

$$D = \beta \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}, \tag{2}$$

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

details of step 0

$$\psi_s \sim GP(0, \Sigma), \tag{3}$$

where,

$$\begin{aligned} \Sigma &= \Sigma(\lambda, \rho) && (4) \\ &= \lambda^{-1} K(\rho), && (5) \end{aligned}$$

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

$$\begin{aligned} K(\lambda, \rho) &= \exp^{-\beta a (\Delta\alpha^2 + \Delta\delta^2)} && (6) \\ &= \rho^{4a(\Delta\alpha^2 + \Delta\delta^2)}, && (7) \end{aligned}$$

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 $d.o.f \to \infty$, it's just a squared exponential kernel

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

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

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

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:

$$\gamma_1, \gamma_2 \sim GP(0, \Sigma^{\gamma}_{xx,yy}(x,y)) \tag{10}$$
$$\kappa \sim GP(0, \Sigma^{\kappa}_{xx,yy}(x,y)) \tag{11}$$

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