02-512 Assignment 06

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(a) The variables we are trying to find are the rate of infection, λ_1 and the rate of recovery, λ_2.

We can run the CTMM as a simulation and compare it with real data. The output of the simulation will be sequence of states over time where each state will be (S_t, I_t, R_t).

Let (Sr_t, Ir_t, Rr_t) be the real data. One possible objective function to minimize is

$$L(\lambda_1, \lambda_2) = \sum_{realdatapoints} (S_t - Sr_t)^2 + (I_t - Ir_t)^2 + (R_t - Rr_t)^2$$

TODO Algorithm

(b) Let G be the growth rate, x_1 be the conc of nutrient 1 x_2 be the conc of nutrient 2.

$$G = \alpha x_1 + \beta x_2 + c$$

Where α, β, c are the parameters we're trying to estimate.

Let $Gr(x_1, x_2)$ be the experimenally determined growth rate.

One possible objective function to minimize is

$$\sum (Gr(x_1, x_2) - G(x_1, x_2))^2$$

We can find the parameters which minimize this using steepest descent.

(c) BB - brown Bb - brown bb - blue

brown = BB + Bb blue = bb

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(a) Let TTR be time to resistance.

TODO GAUSSIAN LIKELIHOOD

(b) TODO GAUSSIAN$\hat{2}$ LIKELIHOOD

(c) Do both and take the one with the smaller error?

(d) Metropolis

(e) Sampling vs solving

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Given two points, the eqn of a line is derived as follows:

(Points given as t2 x2 t1 x1)

t = (x2 - x2)/(t2 - t1) x + b

t1 - (x2 - x2)/(t2 - t1) x1 = b

or

t2 - (x2 - x2)/(t2 - t1) x2 = b

t - t2 = (x2 - x2)/(t2 - t1) * (x - x2)

if $0 \leq t < 2$, t - 2 = (5/2)(x - 5)
if $2 \leq t < 5$, t - 5 = ((6-5)/(5-2))(x-6)
if $5 \leq t < 8$, t - 8 = ((10-6)/(8-5))(x-10)
if $8 \leq t \leq 10$, t - 10 = ((20-10)/(8-10))(x-20)

(b) TODO interp formula

(c) TODO interp formula + some deriv stuff.

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(a)

If b_i is 0, there are no boojum on island i. Based on this observation, we note the following:
$Pr(b_i = 0|f) = (1 - f)^{s_i}$
$Pr(b_i = 1|f) = 1 - (1 - f)^{s_i}$

$$P(b|\theta) = \Pi_{i=1}^{n} Pr(b_i = b_i)$$

(b)