Industry Challenge for BioFest 2015
Vantage Research, Chennai

Motivation

Growth of children is a process that depends on multiple factors such as genetic predisposition, availability of nutrients, environmental stressors etc. The growth rate can be tracked by measuring weight and height and is itself a time-varying parameter. Large databases of these growth curves are maintained by international organizations such as the WHO (WHO growth standards) as well as local organizations specific to a country (e.g. CDC in the United States).
Developing models of human growth which capture data, allow us to understand the dynamics of 'ideal' growth and variations from it in various contexts. Variability exists between genders, amongst geographies and sometimes with socio-economic status and modeling can allow us to investigate why some countries lag in child growth (Review on stunting in low income countries).

Problem

- In the simplest case, the growth rate of children is a time dependent function, that is thought to be dependent on so many factors such as genetic pre-disposition, current height, weight etc, available nutrition etc. .
- Identify the public data set you would like to use (specific age group (e.g. 0 to 5 y), gender (e.g. males), ethnicity (e.g. caucasians)) and identify the independent (time, environmental factors?) and dependent (height, weight) variables of your model (e.g. Height, ages 0 to 5 years, age 5-18)
- Develop a mathematical model (e.g. statistical, algebraic, differential equation based) that captures time variation in mean height and weight and be explicit about your assumptions
- Explore how the parameters of your model can be varied to capture deviations from the mean in height and weight
- If you come up with optimization algorithms to identify parameters, make them explicit
- The model may be expanded to capture growth for a wider age group than originally considered or different demographics factor (e.g. gender) can be included in the model, to make it generic across different populations. Can you

use data and the right control groups to distinguish between variations due to genetic predisposition and environmental effects?

What should results look like?

- Write a 2-3 page report on your data sources, literature survey and assumptions in your model
- Explicitly lay out the mathematical model, parameterization that captures the data and alternate parameterizations to extrapolate to other situations, if any
- What are the primary conclusions, you draw from this model development? What would your next steps be if you had more time/resources?
- Use freely available software when possible (e.g. R, XPP)
- Document your code and plot figures as needed with the references