

Publication

A time-varying biased random walk approach to human growth

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)**ID** 4617114**Author(s)** Suki, Béla; Frey, Urs**Author(s) at UniBasel** [Frey, Urs Peter](#) ;**Year** 2017**Title** A time-varying biased random walk approach to human growth**Journal** Scientific Reports**Volume** 7**Number** 1**Pages / Article-Number** 7805**Mesh terms** Bayes Theorem; Body Height; Body Weight; Child; Child Development; Cohort Studies; Female; Humans; Infant; Infant, Newborn; Male; Models, Theoretical; Prospective Studies

Growth and development are dominated by gene-environment interactions. Many approaches have been proposed to model growth, but most are either descriptive or describe population level phenomena. We present a random walk-based growth model capable of predicting individual height, in which the growth increments are taken from time varying distributions mimicking the bursting behaviour of observed saltatory growth. We derive analytic equations and also develop a computational model of such growth that takes into account gene-environment interactions. Using an independent prospective birth cohort study of 190 infants, we predict height at 6 years of age. In a subset of 27 subjects, we adaptively train the model to account for growth between birth and 1 year of age using a Bayesian approach. The 5-year predicted heights compare well with actual data (measured height = $0.838 \times \text{predicted height} + 18.3$; $R^2 = 0.51$) with an average error of 3.3%. In one patient, we also exemplify how our growth prediction model can be used for the early detection of growth deficiency and the evaluation of the effectiveness of growth hormone therapy.

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