

Circular Statistics in Forth

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Many organisms, and often cells within organisms, move or grow preferentially oriented with respect to specific directions within their environment. Examples of such activity include the motion of white blood cells toward sites of inflammation, the oriented growth of plants toward the sun, and the seasonal migration of birds. To study these phenomena, data may be taken about the direction of movement of individual organisms or cells within a population of similar organisms or cells. Analysis of this data with the use of the branch of mathematics known as circular statistics provides parameters such as the average direction of movement of the population, and more importantly, the dispersion about this average that is exhibited by the population. This parameter is useful in that it represents a quantitative measure of the ability of the population to orient. A small dispersion indicates a high degree of orientation within the population. Observing how drugs, temperature or other perturbations on the biological material effect this parameter is a way to investigate the mechanism causing the orientation. Forth has been used to write routines to do the required circular statistics calculations and to model the behavior of the population using von-Mises distributions from circular statistics. Hardware dependent Forth routines have also been written to provide circular coordinate system histograms of this type of data.