Sonification utility for conveying graphical information

Overview

Accessing graphs and diagrams have always remained a big challenged for the blind and visually impaired. While embossers are one possible solution, many students in the developing world do not have access to these resources. Similarly, only few have the liberty of sighted assistance. These challenges have restricted blind students in several countries from pursuing disciplines that use visual information.

The sonification utility seeks to bridge this gap by providing auditory feedback. This auditory feedback provides a basic intuition of the monotonicity of the curve. In other words, the feedback seeks to give a general idea of the slope at a particular time as the curve progresses.

How the software works?

The software requires the user to enter an equation corresponding to the curve. As of now, the software only supports equations corresponding to a straight line (standard equation), circle, parabola, ellipse and a hyperbola. the user is then prompted to specify the range (lower and the upper bounds). Since the program approximately uses 21 frequencies (referred to as 21 musical notes in the software), it divides the interval uniformly, with appropriate number of notes representing each integral point on the curve. This information is conveyed to the user as a reference.

To indicate origin and other points of interest (such as when the line crosses the axes etc.), special distinctive sounds are used. this helps the user confirm his understanding of the curve.

Underlying principle

The software is provided with a set of possible equations representing the most popular standard curves. When the user specifies an equation which matches an already existing equation alongwith the range, the software computes how the curve would progress Mathematically. It then loads the appropriate file, representing either a negative slope or a positive slope. Using the

fact that the software uses 21 Musical frequencies, the software calculates the approximate time that origin will be hit, and loads the file containing the distinctive sound.

Advantages

This software was developed as a resource to help me (Kartik) better understand the curves in my Calculus class in high school. As a result, it supports all the curves in grades 11 and 12 curriculum as laid down by the Central Board of Secondary Education in India. The software is also reasonably efficient at conveying a clear layout of the image.

Limitations/potential improvements

I look forward to including more equations. It will also be wonderful to incorporate sonification of imported images. Another great feature will be to include verbal descriptions of the curves to make the information much more comprehensive and effective.