

animatoR: dynamic graphics in R

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Graphics, especially dynamic graphics, is an impressive tool in various demonstrations. In statistics teaching, there are many situations where graphics with animation of certain elements of the picture communicate the concepts in obvious way.

Since R graphic devices are in a sense static, several approaches towards dynamic graphics are used. On many occasions, one would like to move certain graphical element, for example one point, on otherwise static picture. One way is to hide the point by re-plotting it in exclusive OR (XOR) mode and plotting the point in a new position. This method can be fast since one is plotting only the elements that are changing on the otherwise static background which can be very complex. R graphic devices are not suitable for such technique. Another way, which is close to this technique, is hiding the dynamic elements by re-plotting them in the background color. This works only for pictures with solid single color background and proves to be unsatisfactory. Another technique is to simply plot a series of complete pictures, each one with relocated picture elements. If the pictures are not very complex, R is fast enough (if not too fast) for producing a flicker free dynamic impression. This is the most popular technique, which can provide satisfactory results.

To get an impression of smooth movement, the changes in successive pictures should be small and one needs to get many intermediate point or line positions. Here we provide technique and a set of functions that complement base graphics function for production of dynamic graphics. The basic idea is to define the starting and finishing coordinates of moving picture elements (points, lines, segments, etc.). Then we plot a series of pictures for successive intermediate positions, which are calculated by homotopy between starting and finishing values. If start position is x_0 and end position is x_1 than positions between them can be determined as

$$x_t = x_0(1 - t) + x_1t, \quad t \in [0, 1]$$

for different values of homotopy parameter t . Selection of suitable sequence for homotopy parameter t provides an impression of smooth movement along trajectories from starting to finishing positions.

Package **animatoR** is a developing package utilizing homotopy for production of smooth dynamic graphics, with the motive of presentations and use in teaching. In the presentation, several examples that demonstrate the use of dynamic graphics in statistics teaching will be shown.