36-350: Data Mining

Date: October 30, 2002

Homework 10

Due: start of class November 4, 2002

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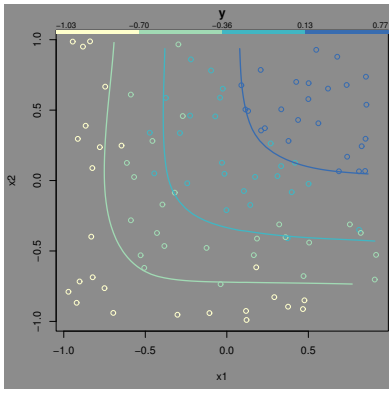
1. This question teaches you how to recognize different kinds of interactions in data. Consider the following four kinds of interaction:

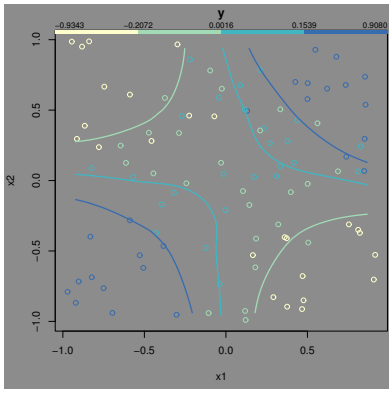
   amplifier: $y = -x_1(1 - x_2)$ minimum: $y = \min(x_1, x_2)$

   switch: $y = \begin{cases} 0 & \text{if } x_2 \geq 0 \\ -x_1 & \text{if } x_2 < 0 \end{cases}$ bilinear: $y = x_1 x_2$

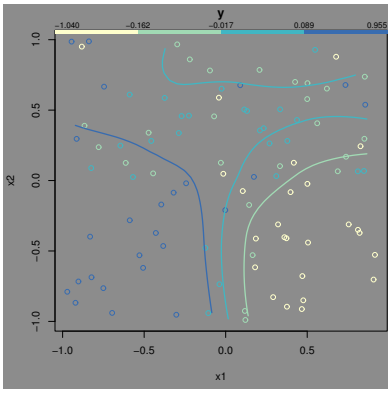
   Each of them is depicted in one contour plot and one slice plot below, but not necessarily in order. Noise has been added too. For each formula, pick the correct contour plot and slice plot. (Note that the axes and the coloring may be different between plots.)



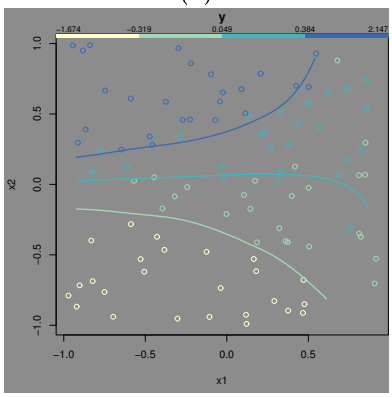
(a)



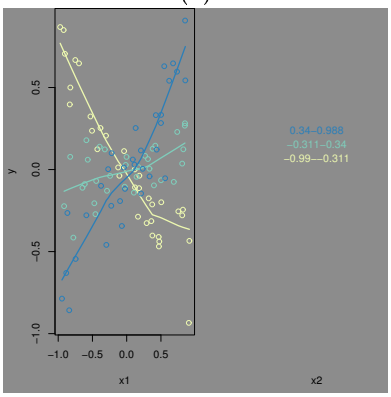
(b)



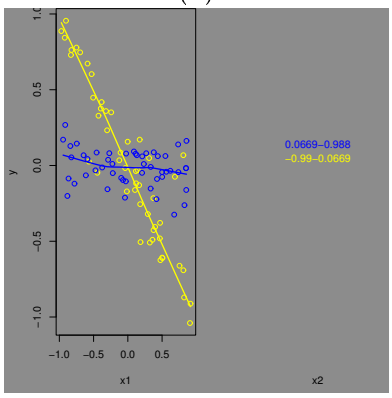
(c)



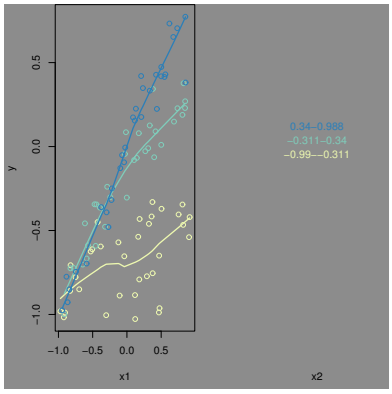
(d)



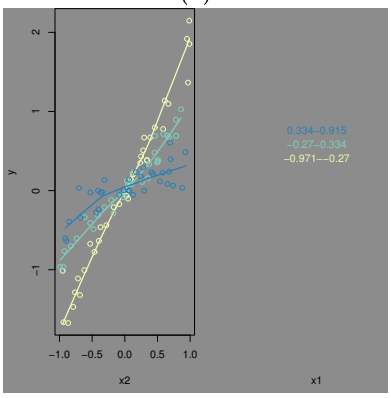
(e)



(f)



(g)



(h)

2. In the previous lab, you constructed a linear model to predict the sales of one product as a function of the prices of other products. In this week's lab, you examined the interactions between the prices in predicting sales. Each of the interactions resembles one the interaction types from the previous problem.

   (a) For each of the four interactions from lab, name the interaction type from the previous problem which best matches it. Justify your answer by including the relevant plots from lab.

   (b) Describe what each of these interactions means from the perspective of grocery pricing and sales, without using formulas. More complete answers get more credit. (But try to be concise. You can use the product numbers as shorthand for their names.)