FDS Homework 7

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1 Softmax

The softmax function makes several different kinds of multi-class classifiers possible. We need to understand softmax. Make a LaTeX document called Softmax.tex. In that file, answer the following questions. Turn in Softmax.pdf

1.1 2.1 Compute a softmax

What is the softmax of the vector [5, 3, 0, 1]? (Hint: the answer is also a vector.)

Answer: $\begin{bmatrix} 0.87370431 & 0.11824302 & 0.00588697 & 0.0021657 \end{bmatrix}$

1.2 2.2 6780 Students only: Compute the Jacobian of the softmax

If you have a function f : Rn → Rm, we can think of that as m functions f1 : Rn → R, f12Rn → R,. . ., fm : Rn → R.

What is the jacobian of the softmax function at [5, 3, 0, 1]?

Answer as one vector: $\begin{bmatrix} 14.7781122 & -63.05530884 & 0 & 0 \end{bmatrix}$

Answer as multiple broken down matrices:

$$\begin{bmatrix} \begin{bmatrix} \begin{bmatrix} 2 & 0 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} -2.14455198 & 0 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 2 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & -9.45715881 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix} \end{bmatrix} \\ \begin{bmatrix} \begin{bmatrix} 0 & 0 & 2 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & -170.86657547 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & 2 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & -462.74522535 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix} \\ \begin{bmatrix} 0 & 0 & 0 & 0 \end{bmatrix} \end{bmatrix} \end{bmatrix}$$