Data Science: Deep Learning Prerequisites – Linear Reg in Python Notes

**Section 2: 1-D Linear Regression Theory and Code**

**Linear regression in python**

this isa lecture

ohm’s law V=IR is a linear equation

V=vol tate

I=current

R=resistance

Current (I) is the independent variable

given a set of inputs and outputs you can plot on graph

creates an almost perfect line

always some element of error

drawing the line of best fit

try to calculate the slope of the lin

R=slope=V/I

linear can apply to anything

blood pressure versus age

blood pressure vs weight

All data is the same

there is a systematic way to find line of best fitSimple linear regression

this is yi=axi+b

y*i*is expected y

xi is the input ex

we want the line of best fit to be as close to possible (minimizing error)

finding differences does not work

errors of +5 and -5 = 0

Step 1: need to find the “sum of squared errors”

Error (E)=summation (yi-yhati)2

Step 2: take the derivive of Error function to minimize the result

example

E=0.5t2-t

E`=t-1

so by setting derivative equal to 0

0=t-1

t=1

in our problem

Error (E)=summation (yi-yhati)2

So pluggin in our line of best fit function

E=summation(yi-(axi+b))2 or E=summation(yi-axi-b)2

yi and xi are given due to datapoints

have to take partial derivatives since multiple variables <https://www.youtube.com/watch?v=SbfRDBmyAMI>

<https://www.google.com/search?q=finding+derivatives+polynomials&ie=utf-8&oe=utf-8&client=firefox-b-1-ab#kpvalbx=1>

<https://www.youtube.com/watch?v=-_8DFxTl0Ls>

<http://polisci.msu.edu/jacoby/msu/ppl801/handouts/Handout,%20Summations,%202010.pdf>

Need to use the chain rule on the original ufnction to get the derivative

<https://www.khanacademy.org/math/ap-calculus-ab/ab-derivative-rules/ab-chain-rule/v/chain-rule-introduction>

Steps:

1. take derivative of outside quantity

2. need to then mulitpily result by derivative of interior

example

h(x)=(sinx)2

h`(x)=(dh/dx)=2(sinx)(derivative of sign x)

look at notes to show that you can convert

sum(xi)=X bar (if divided by N)

dot product resources:

<https://en.wikipedia.org/wiki/Dot_product>

**see notes sheet**

**Define the problem derive the solution**

process

1. define the problem

start with training samples that resemble a line

inputs (x1, x2 x3 x4)

outputs (y1, y2, y3,…)

line defined in yhat=ax+b

**Summary:**

In theory (this may just be the proof)

1. find the equation of the sum of square derrors

2. take partial derivatives of a and b and set to zero, then solve to get minimum a and b values

3. those create the line of best fit

4. next steps: get line of best fit

**Exercise: Theory Versus Coding**

the code helps conceptualize the results

**R-Squared Quiz:**

1. What leads to a negative R2?

we predict worse than mean of the target values

it would have been better to predict just the mean of the target values