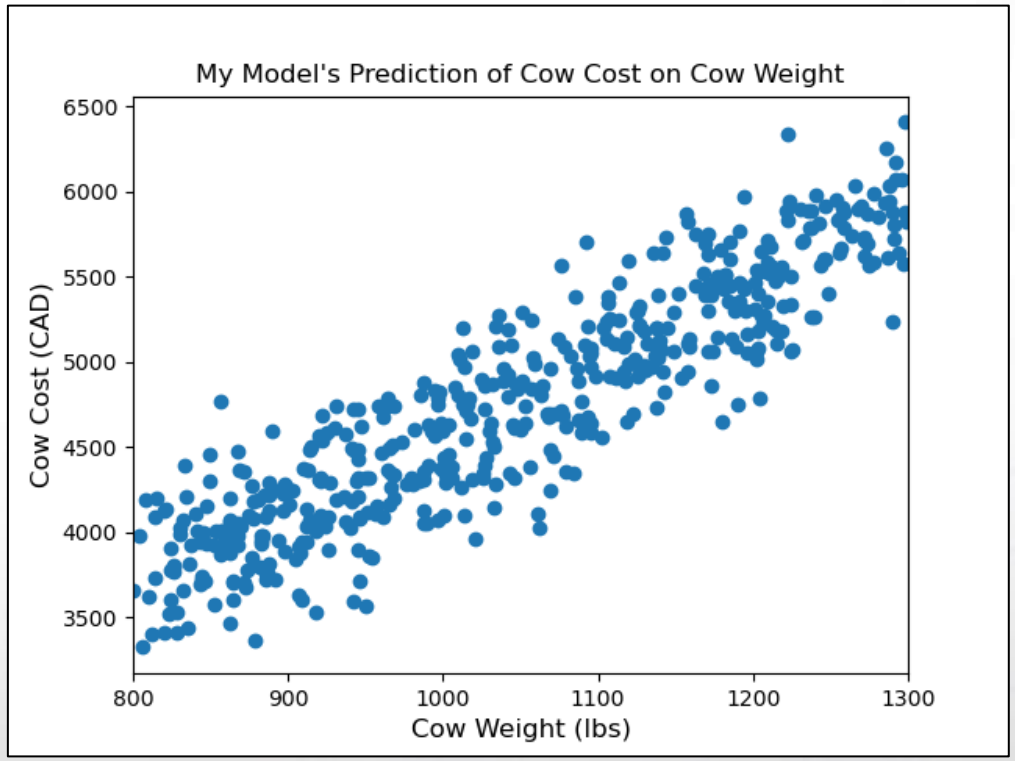
BRAINTANK
DEEP LEARNING

Week 1:
Cows Getting Deep

October 16th, 2021

Problem:

The University of Guelph Agriculture department is looking to buy 3 new cows for study. One small cow (900 lbs), one medium cow (1050 lbs), and a large cow (1200 lbs). They need BrainTank to develop a deep learning algorithm to determine the price they should be expected to pay for each cow. They give us a chart of all the previously sold cows on the market.



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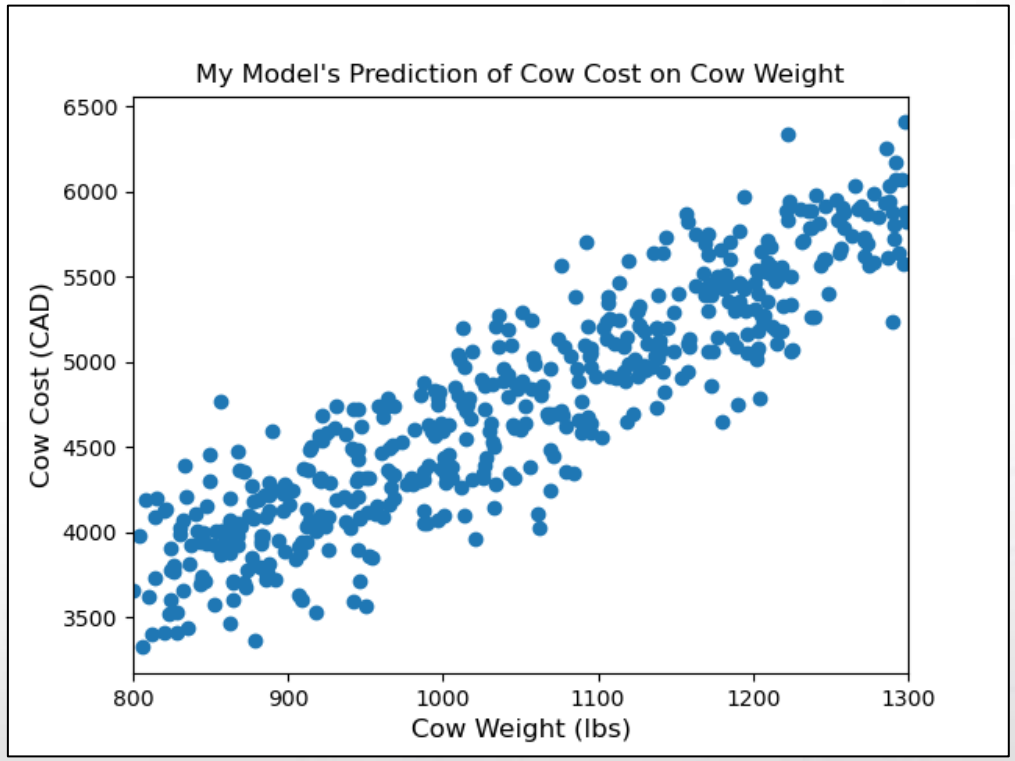
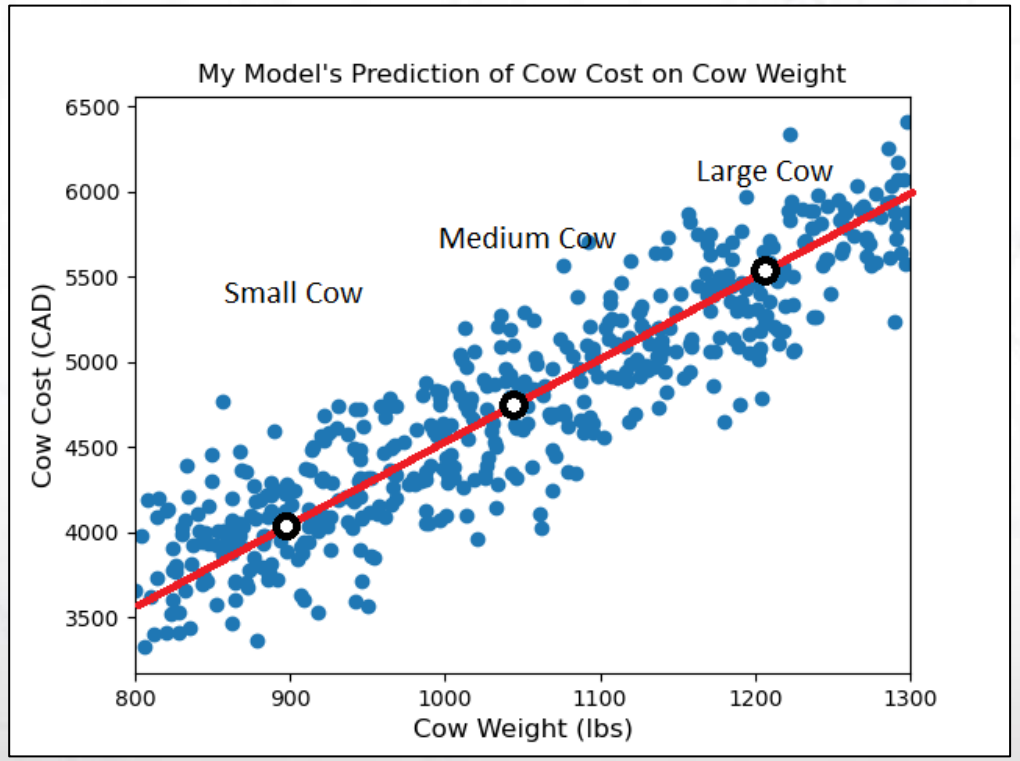




Solution:

$$P = m*W + b$$

P: Price of cow

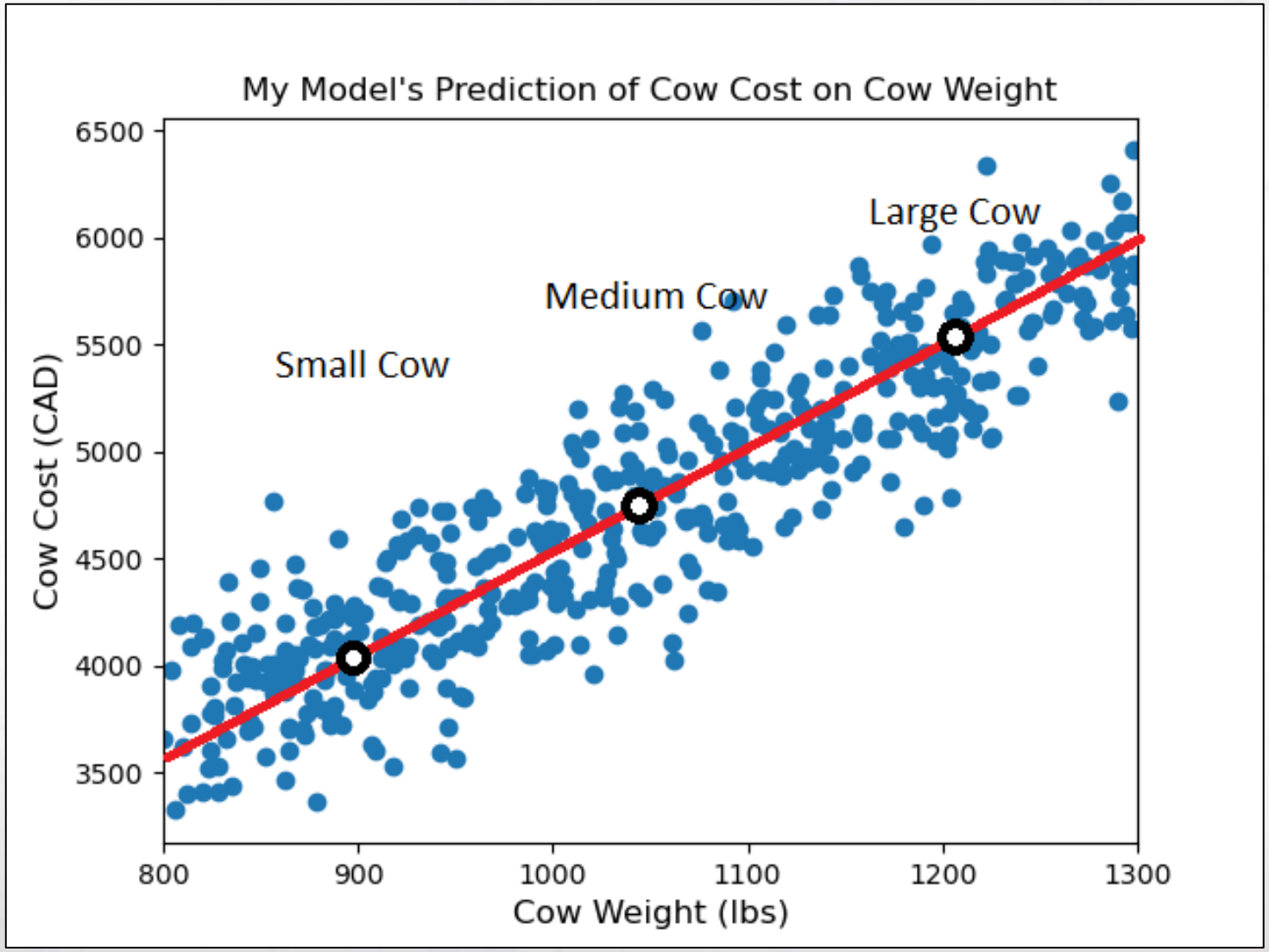
W: Weight of cow

m: Slope coefficient

b: Vertical transition

Parameters:

m and b are the model's parameters. By finding the best values of these parameters we can create a well performing model. By finding bad values, we will create a poorly performing model.



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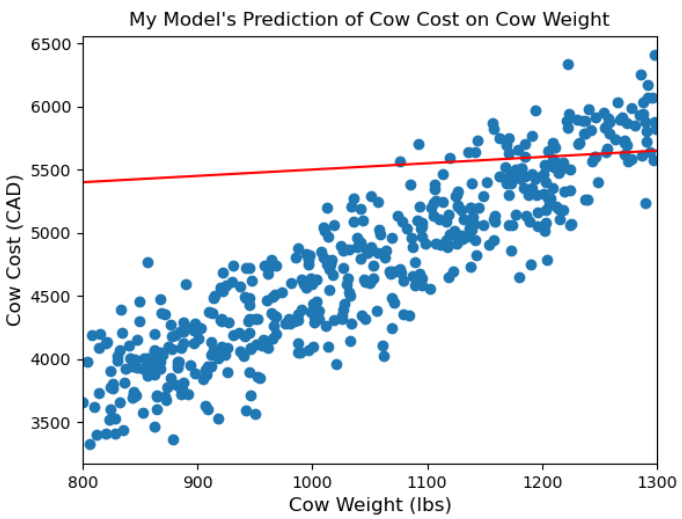
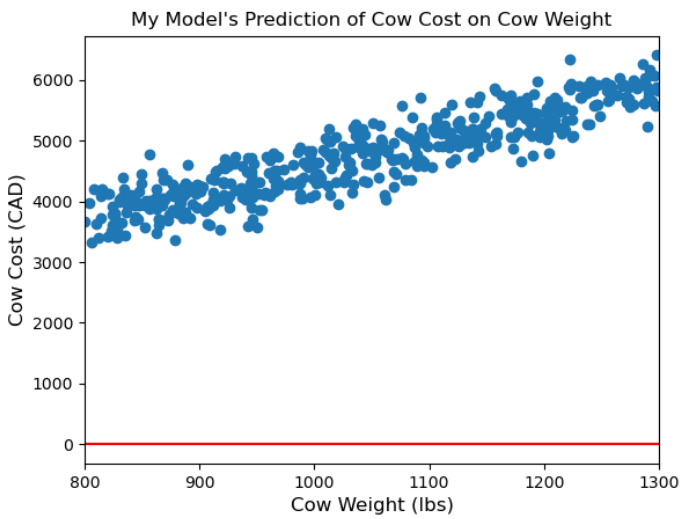


P = 0.5*W + 1000



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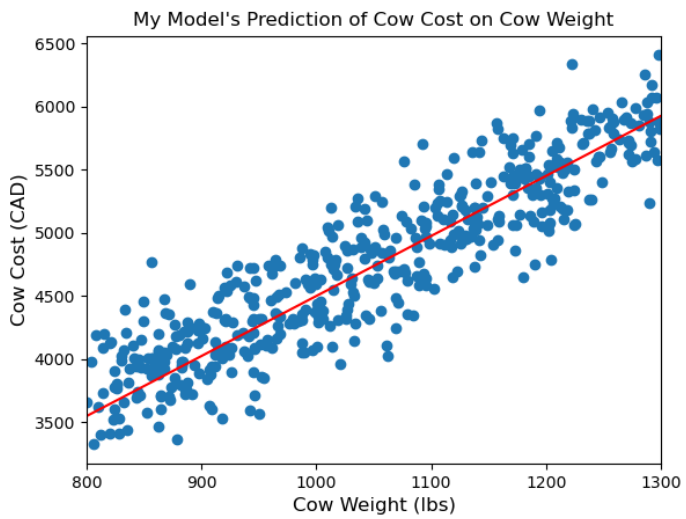

P = ?*W + ?

The 3 Tenets of Deep Learning:

BRAINTANK DEEP LEARNING

Dataset:

- A set of data that has information that we can use to teach the model how to preform better.

Model:

- Mathematical function (equation) that takes an input and creates a desired output. It is defined by its parameters, which are numbers we train/change to get a desired result.

Loss:

- A mathematical equation to measure how well/poorly your model is doing at completing a task.

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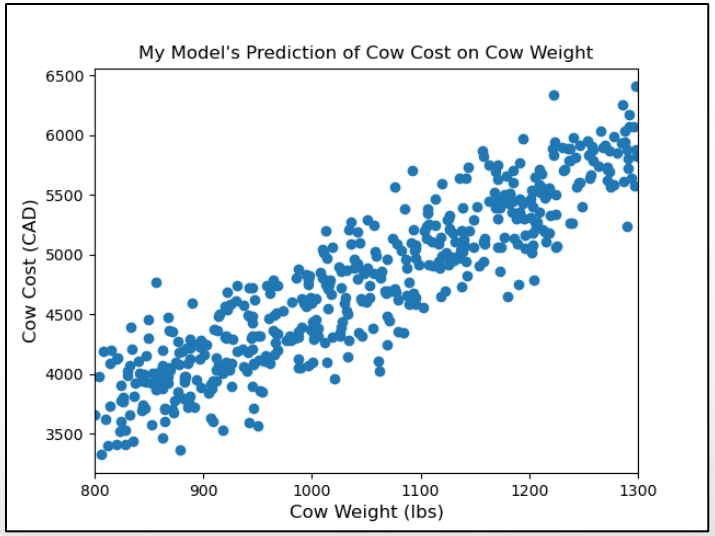

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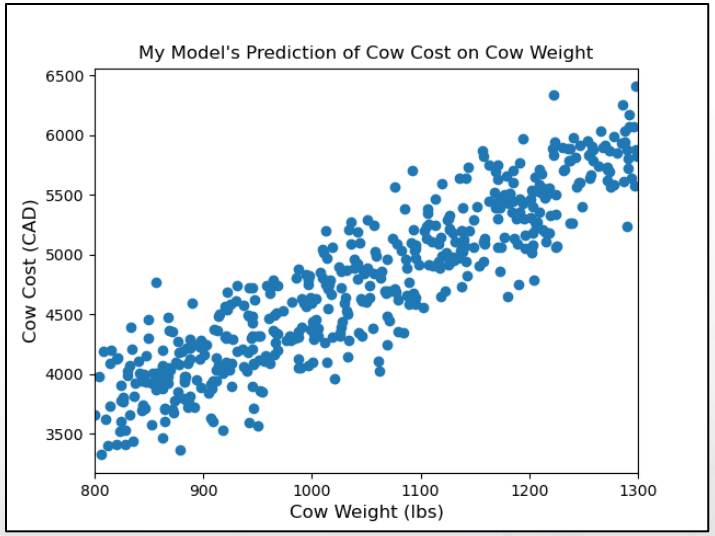

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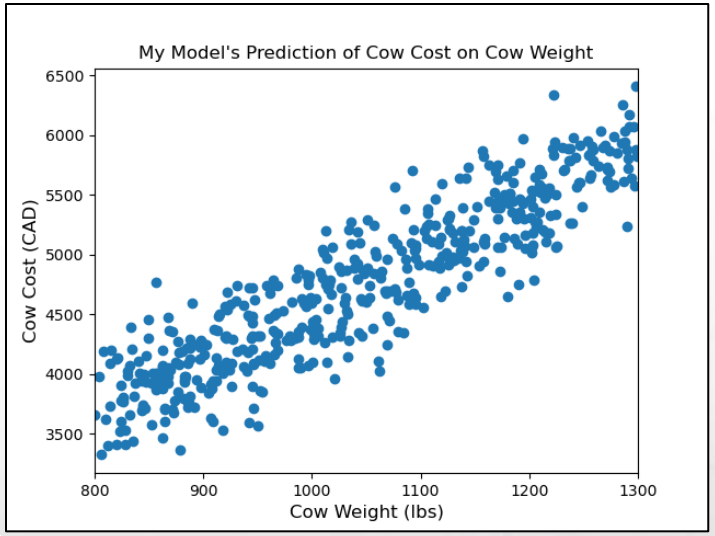

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$$\text{MSE} = \frac{1}{N}\sum_{i=1}^{N}(y_i - \hat{y}_i)^2$$

The Deep Learning Flow:

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1. Initialize your model. Randomly assign your parameters a value.
2. Grab a single entry from the dataset. An input and the ground truth associated with that input.
3. Take that input and put it through the model and save the result.
4. Use the loss function to measure how different the result is from the ground truth.
5. Give the OPTIMIZER, it will then measure how it needs to change the parameters (numbers we change to get a desired result).
6. Repeat steps 2-5 many many times, until the model can perform the task you are asking it to do

The Deep Learning Flow:

BRAINTANK DEEP LEARNING

Dataset:

Cow Weight (lbs)	Cow Cost (CAD)
942	4724
832	3657
922	4541
806	3326
1015	4710
…	

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Model:

$$P = m*W + b$$

$$P = 0.5*(942) + 1000$$

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Model:

$$P = m*W + b$$

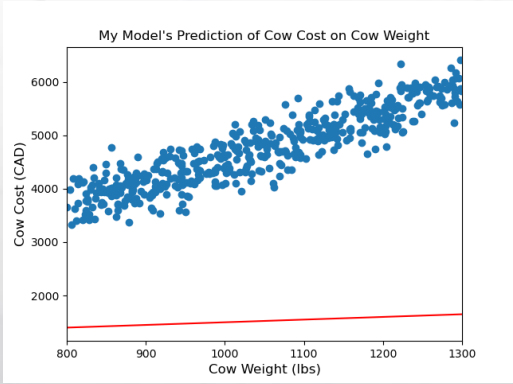
$$P = 0.5*(942) + 1000$$

Result:

$1471

Ground Truth:

$4724



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Model:

$$P = m*W + b$$

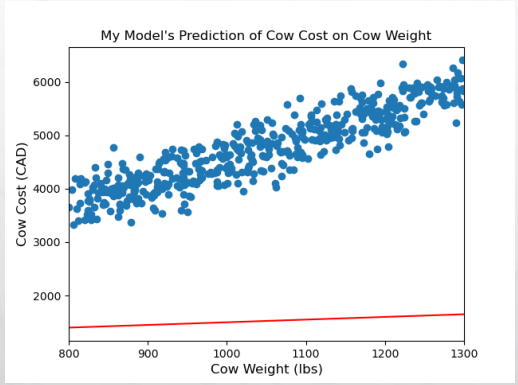
$$P = 0.5*(942) + 1000$$

Result:

$1471

Ground Truth:

$4724



Loss Function (measure of model success):

$$L = (\text{Result} - \text{Ground Truth})^2$$

$$L = (1471 - 4724)^2$$

$$L = 10{,}582{,}009$$

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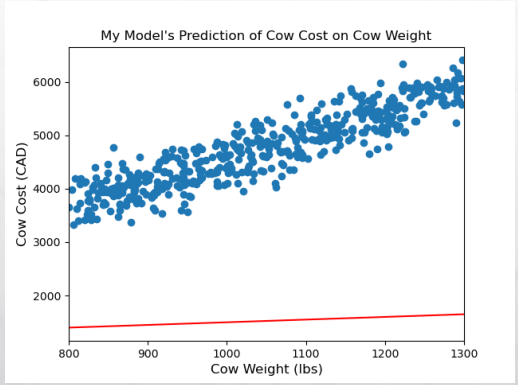
Result:

$1471

Ground Truth:

$4724



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OPTIMIZER:

The OPTIMIZER will look at the loss, and use it to determine how to adjust the models parameters. We want the loss to be small and the model will try and reduce it for us.

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Cow Weight (lbs)	Cow Cost (CAD)
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Model:

$P = m*W + b$

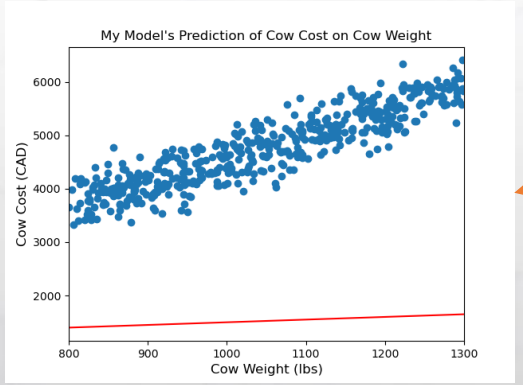
$P = 0.5*(942) + 1000$

Result:

$1471

Ground Truth:

$4724



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$L = (\text{Result} - \text{Ground Truth})^2$

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Cow Weight (lbs)	Cow Cost (CAD)
942	4724
832	3657
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1015	4710
…	

Model:

$$P = m*W + b$$

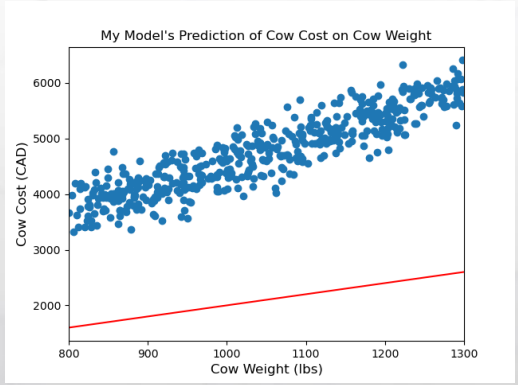
$$P = 2*(942) + 500$$

Result:

$1471

Ground Truth:

$4724



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Model:

$$P = m*W + b$$

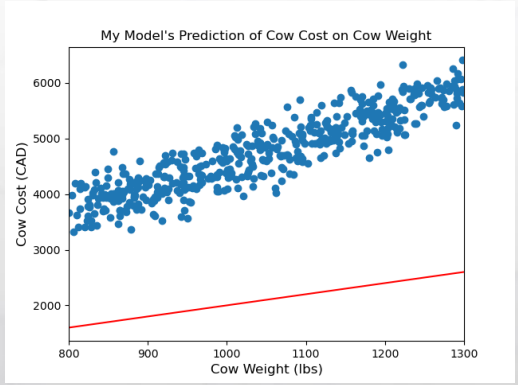
$$P = 2*(832) + 500$$

Result:

$1471

Ground Truth:

$3657



Loss Function (measure of model success):

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Cow Weight (lbs)	Cow Cost (CAD)
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…	

Model:

$$P = m*W + b$$

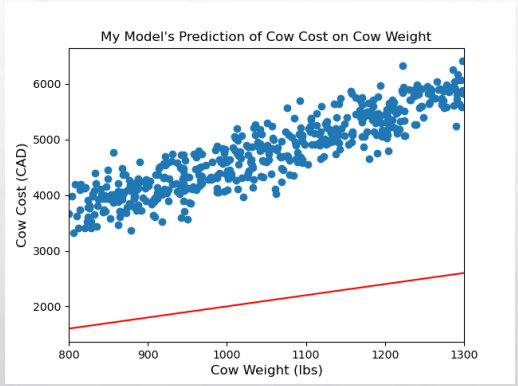
$$P = 2*(832) + 500$$

Result:

$2164

Ground Truth:

$3657



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Model:

$$P = m*W + b$$

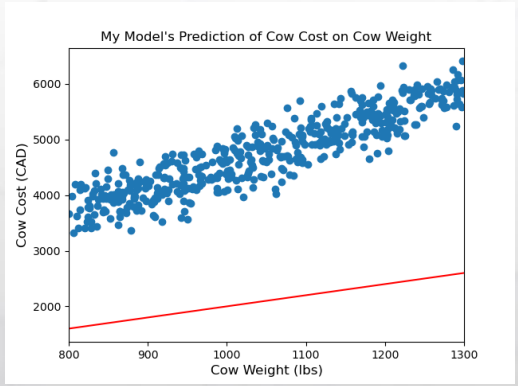
$$P = 2*(832) + 500$$

Result:

$2164

Ground Truth:

$3657



Loss Function (measure of model success):

$$L = (\text{Result} - \text{Ground Truth})^2$$

$$L = (2164 - 3657)$$

$$L = 2{,}229{,}049$$

OPTIMIZER:

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Model:

$$P = m*W + b$$

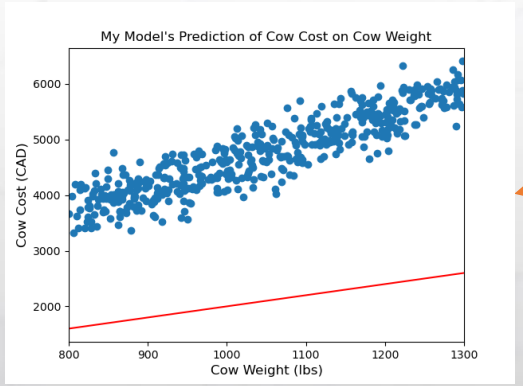
$$P = 2*(832) + 500$$

Result:

$2164

Ground Truth:

$3657



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Model:

$$P = m*W + b$$

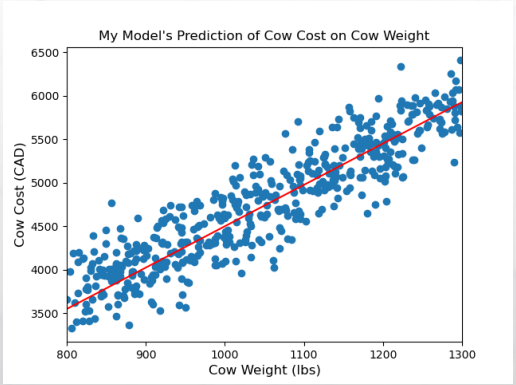
$$P = 4.75*(942) - 500$$

Result:

$2164

Ground Truth:

$3657



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A mathematical equation to measure how well/poorly your model is doing at completing a task.

1. This loss function is to be MINIMIZED. That is to say that a model that produce results, that create a lower loss score is the better model.

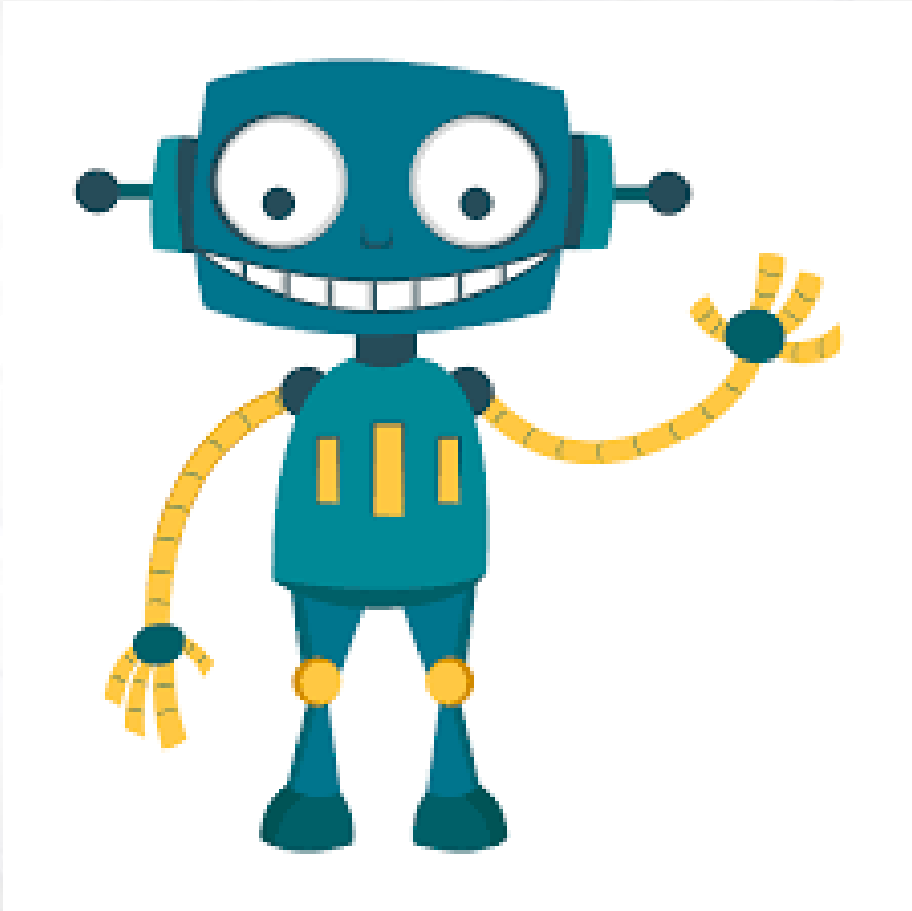
2. We can see that if the Result and Ground Truth are the same/similar L approaches 0.

3. We can see that if the Result and Ground Truth are very different the loss score will be very high.

Since our goal is to create a model that can predict the Ground Truth (cost of the cow) from the input (weight of the cow), we want our model result and Ground Truth to be similar. So, if create a low loss, we know we are doing our job correctly.

The OPTIMIZER:

- Complex mathematical function that is able to figure out how to change the model's parameters to create better results in the loss function.
- The OPTIMIZER is based on very hardcore calculus, and we will NOT be doing an in depth analysis on it during this course.
- We will instead learn how to USE IT to get great results.
- Treat the OPTIMIZER as a friendly robot who helps you tune your model, to solve a task



BRAINTANK

DEEP LEARNING