

**Exercise Sheet 09**  
**Distributed Data Analytics**  
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**Note : The codes are provided in the respective folders**

**Exercise 1: Logistic Regression on Iris Dataset**

**Output:**

When the program first starts, the loss is big. But as we run more epochs, the cost starts to decrease and accuracy continues to increase.

```
khalid@ubuntu: ~/Documents/Homework09
khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x
2017-06-23 00:40:29.358415: W tensorflow/core/platform/cpu_feature_guard.cc:45]
The TensorFlow library wasn't compiled to use FMA instructions, but these are av
available on your machine and could speed up CPU computations.
Epoch: 0001 cost= 0.987766337
Epoch: 0002 cost= 0.855210392
Epoch: 0003 cost= 0.764939690
Epoch: 0004 cost= 0.701529618
Epoch: 0005 cost= 0.654901743
Epoch: 0006 cost= 0.619119702
Epoch: 0007 cost= 0.590637132
Epoch: 0008 cost= 0.567261304
Epoch: 0009 cost= 0.547584212
Epoch: 0010 cost= 0.530668545
Epoch: 0011 cost= 0.515869826
Epoch: 0012 cost= 0.502731804
Epoch: 0013 cost= 0.490923162
Epoch: 0014 cost= 0.480197845
Epoch: 0015 cost= 0.470369393
Epoch: 0016 cost= 0.461293979
Epoch: 0017 cost= 0.452858800
Epoch: 0018 cost= 0.444974172
Epoch: 0019 cost= 0.437567935
Epoch: 0020 cost= 0.430581148
Epoch: 0021 cost= 0.423965333
```

As we can see, the cost continues to decrease

```
khalid@ubuntu: ~/Documents/Homework09
khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x
Epoch: 0060 cost= 0.287086289
Epoch: 0061 cost= 0.284957017
Epoch: 0062 cost= 0.282869074
Epoch: 0063 cost= 0.280821254
Epoch: 0064 cost= 0.278812324
Epoch: 0065 cost= 0.276841204
Epoch: 0066 cost= 0.274906795
Epoch: 0067 cost= 0.273008067
Epoch: 0068 cost= 0.271144052
Epoch: 0069 cost= 0.269313738
Epoch: 0070 cost= 0.267516210
Epoch: 0071 cost= 0.265750610
Epoch: 0072 cost= 0.264016079
Epoch: 0073 cost= 0.262311809
Epoch: 0074 cost= 0.260636959
Epoch: 0075 cost= 0.258990802
Epoch: 0076 cost= 0.257372607
Epoch: 0077 cost= 0.255781628
Epoch: 0078 cost= 0.254217198
Epoch: 0079 cost= 0.252678657
Epoch: 0080 cost= 0.251165334
Epoch: 0081 cost= 0.249676651
Epoch: 0082 cost= 0.248211989
Epoch: 0083 cost= 0.246770746
```

Here, I have tested the data on the test set, and the result are as follows, Accuracy is 100%

```
khalid@ubuntu: ~/Documents/Homework09
khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x
Epoch: 0287 cost= 0.135334332
Epoch: 0288 cost= 0.135122885
Epoch: 0289 cost= 0.134912674
Epoch: 0290 cost= 0.134703681
Epoch: 0291 cost= 0.134495882
Epoch: 0292 cost= 0.134289282
Epoch: 0293 cost= 0.134083873
Epoch: 0294 cost= 0.133879647
Epoch: 0295 cost= 0.133676601
Epoch: 0296 cost= 0.133474681
Epoch: 0297 cost= 0.133273928
Epoch: 0298 cost= 0.133074287
Epoch: 0299 cost= 0.132875783
Epoch: 0300 cost= 0.132678416

Optimization Finished!

Now Testing on Test Set

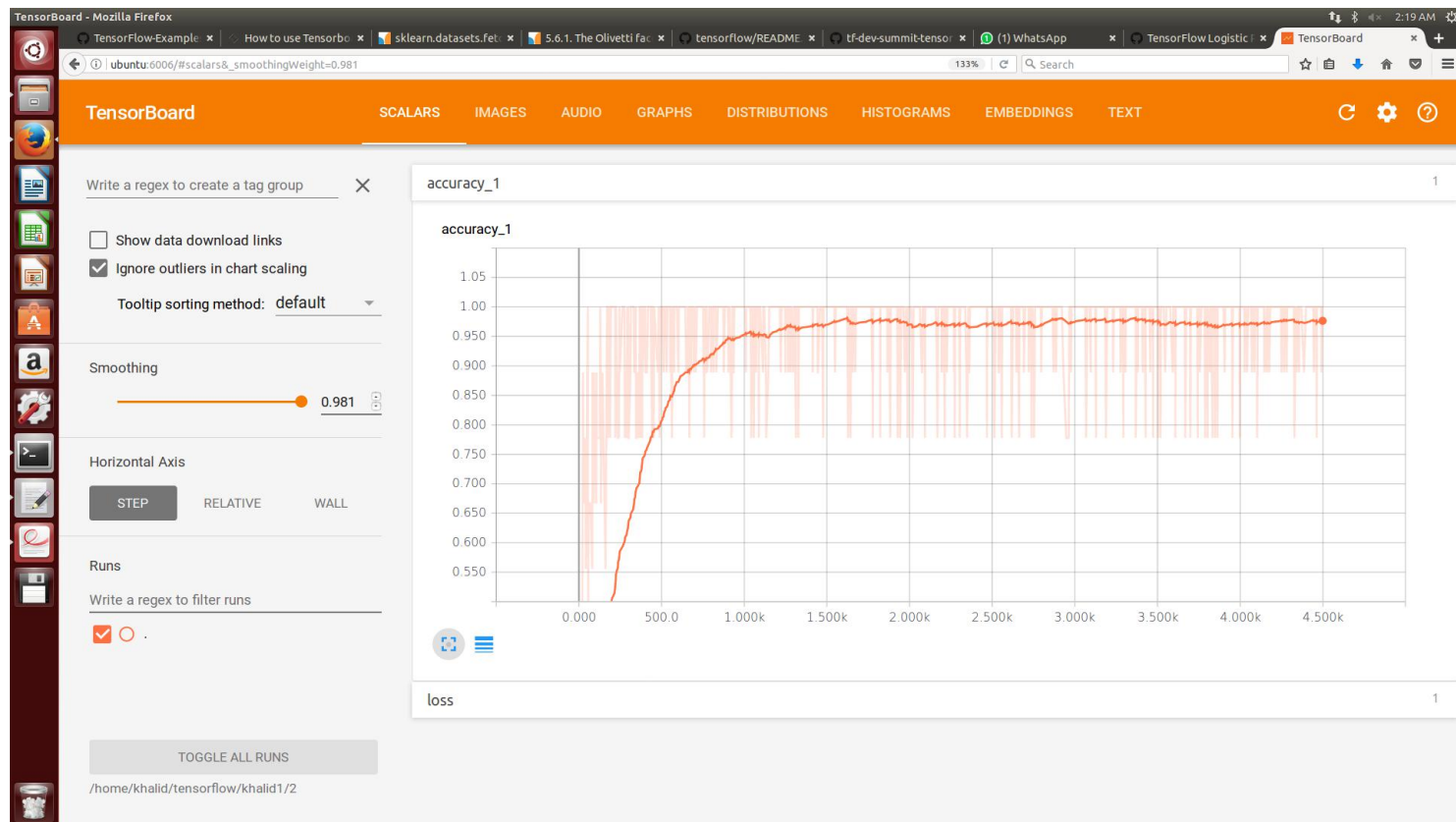
Accuracy on Test Set is : 1.0

khalid@ubuntu:~/Documents/Homework09$
```

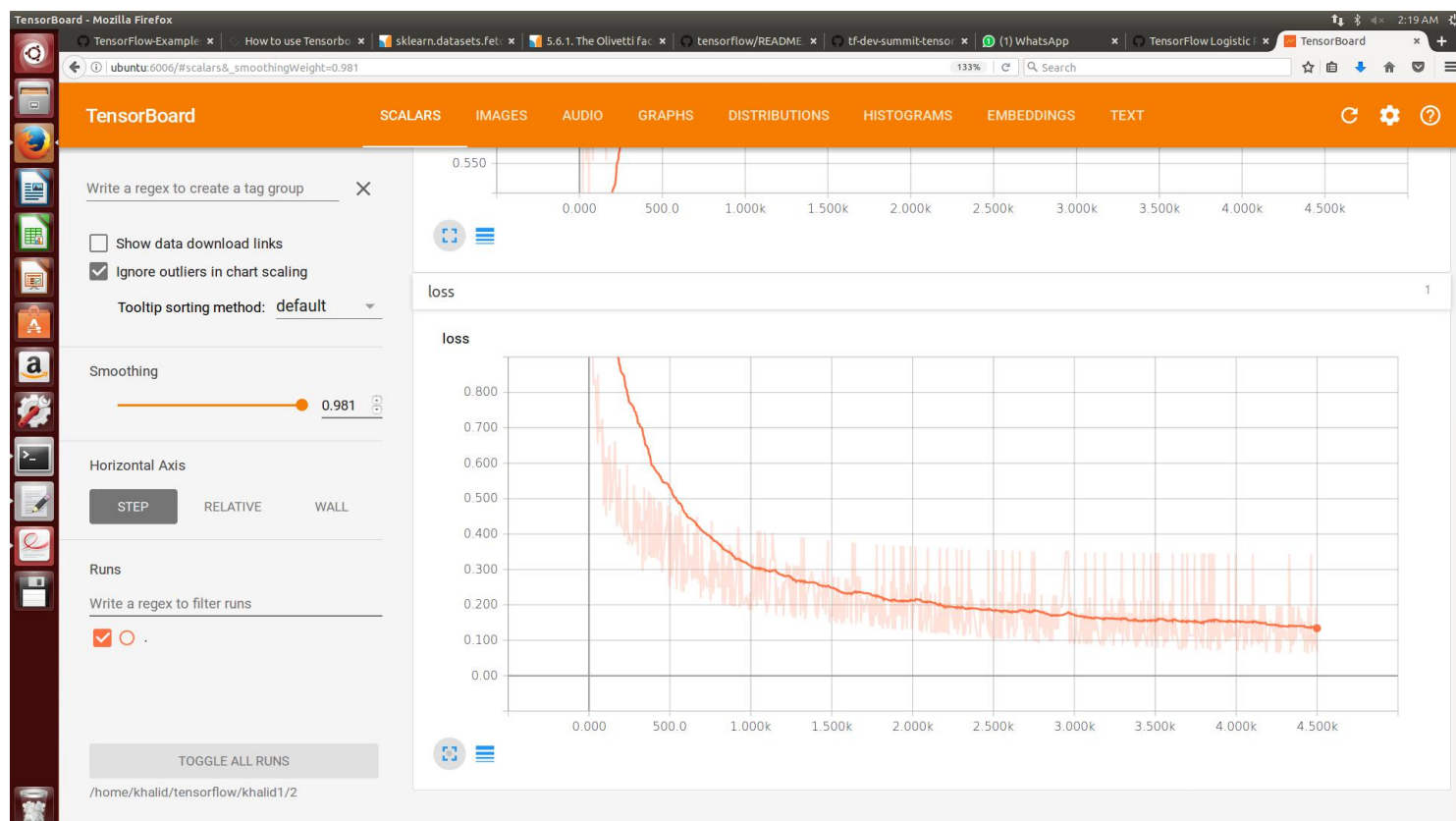
## Scalar Values:

Below are the scalar values for Accuracy and Loss in the TensorBoard.

### Accuracy:



### Loss:

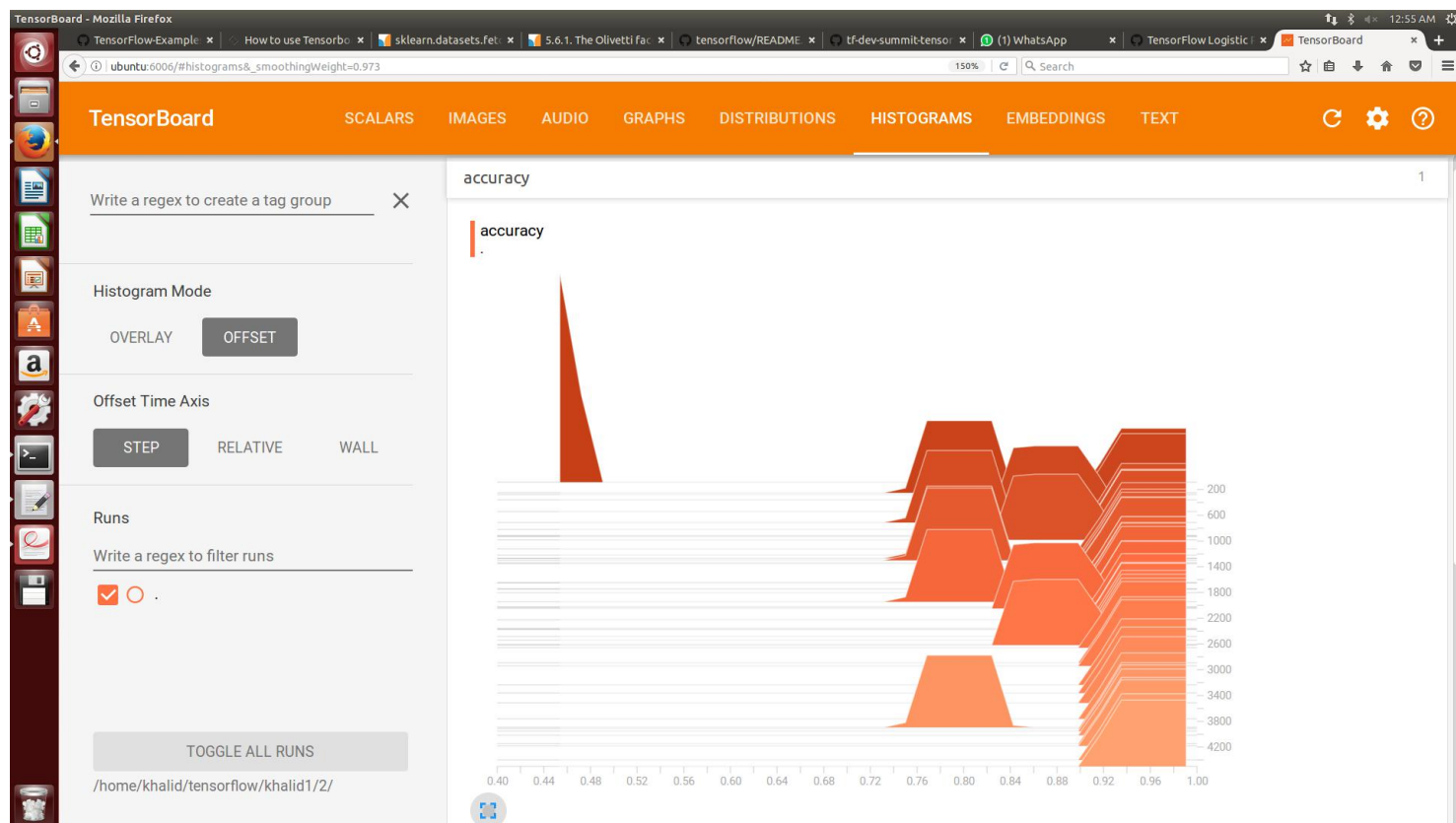




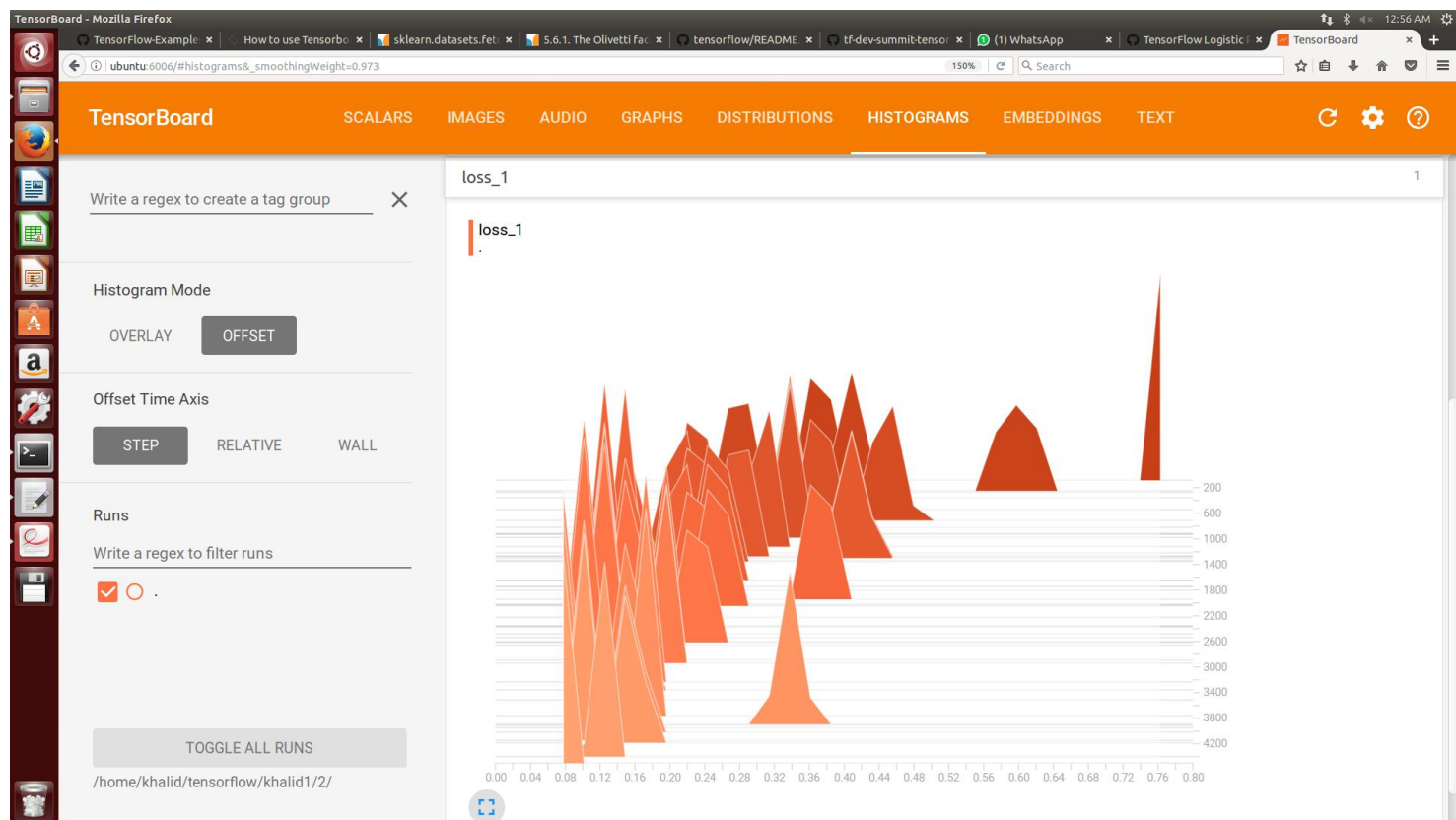
## Histogram:

Below are the Histograms for Accuracy and Loss

### Accuracy:



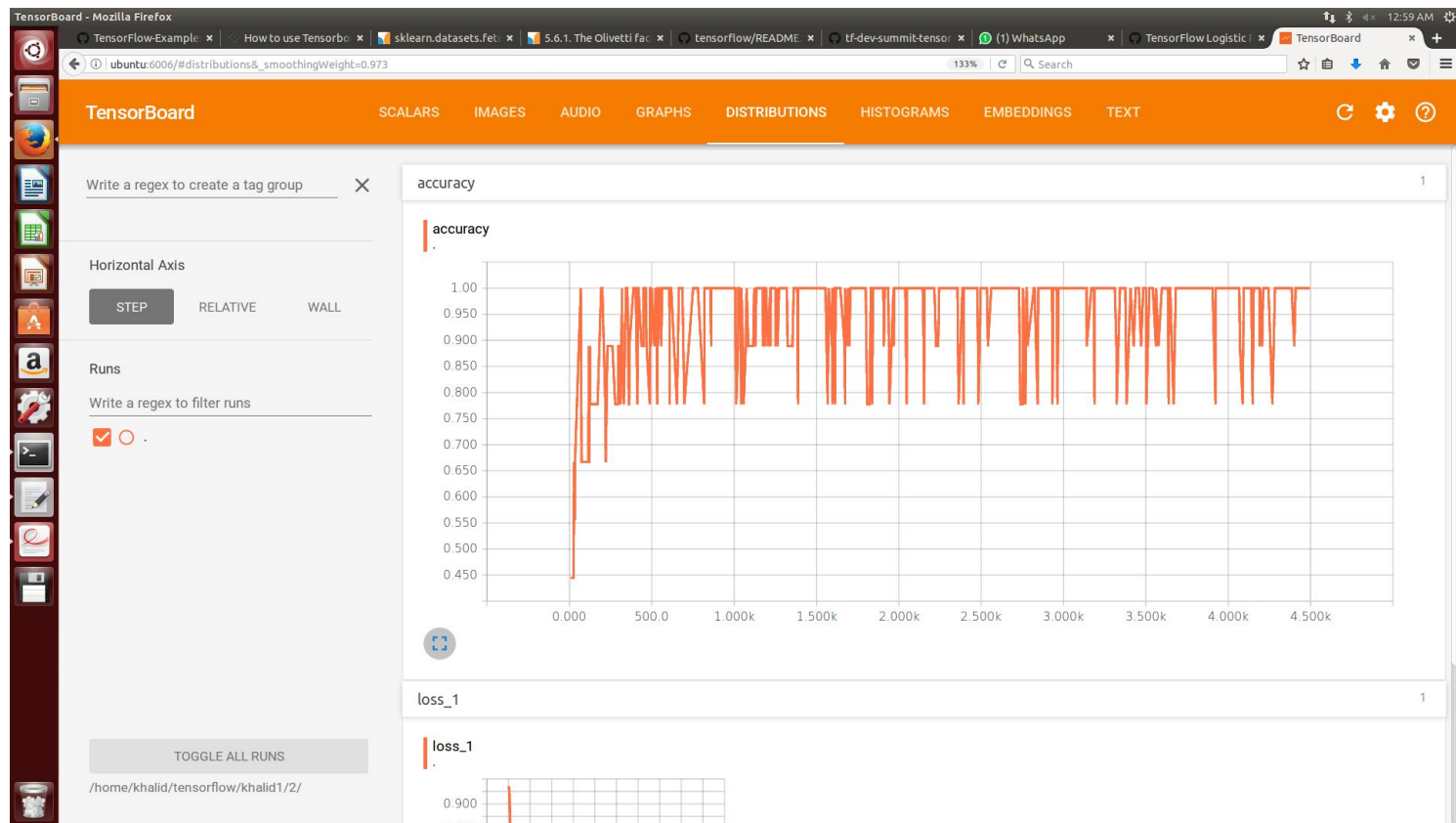
### Loss:



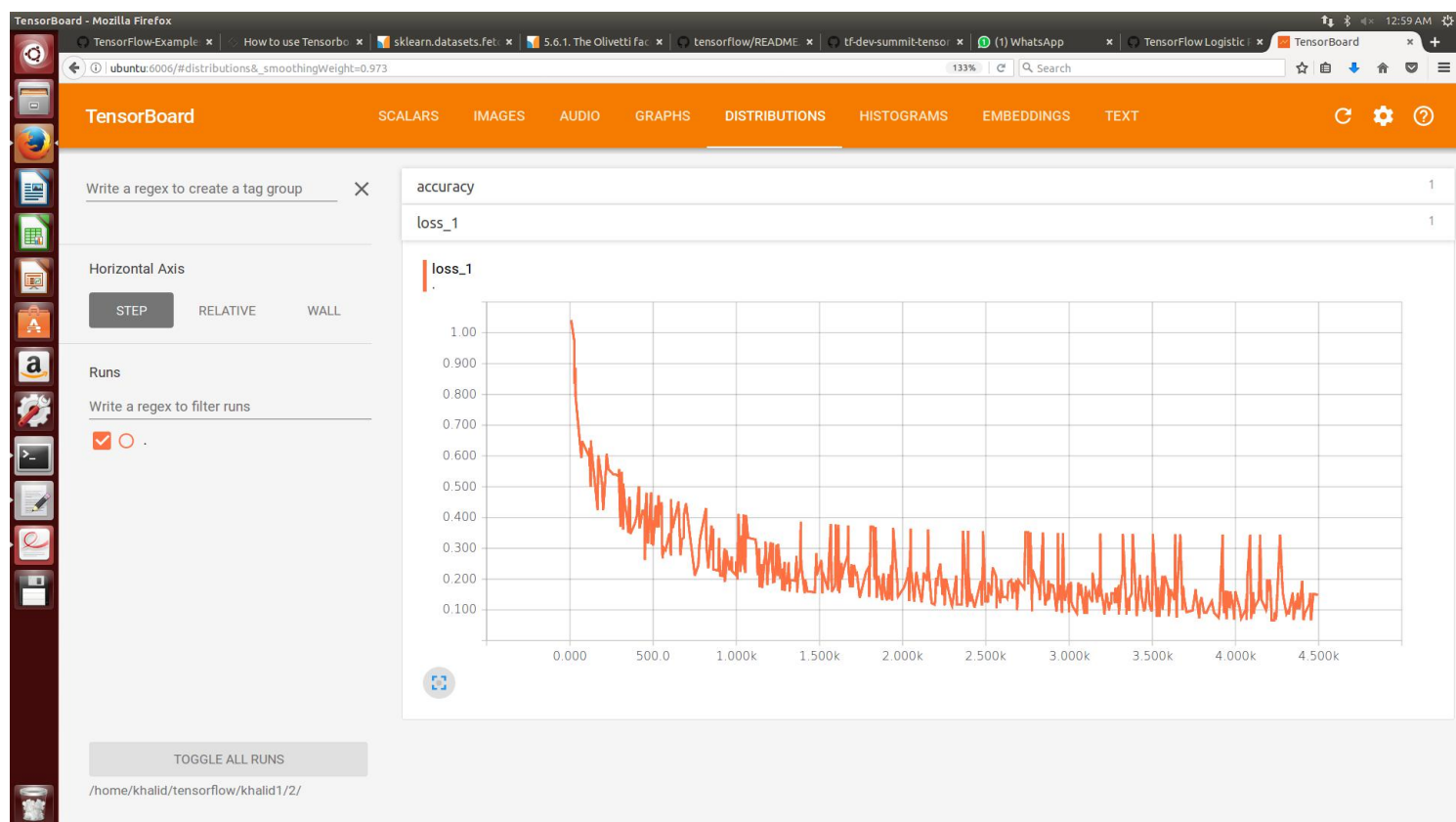
## Distributions:

Below are the distribution values for Accuracy and Loss.

### Accuracy:

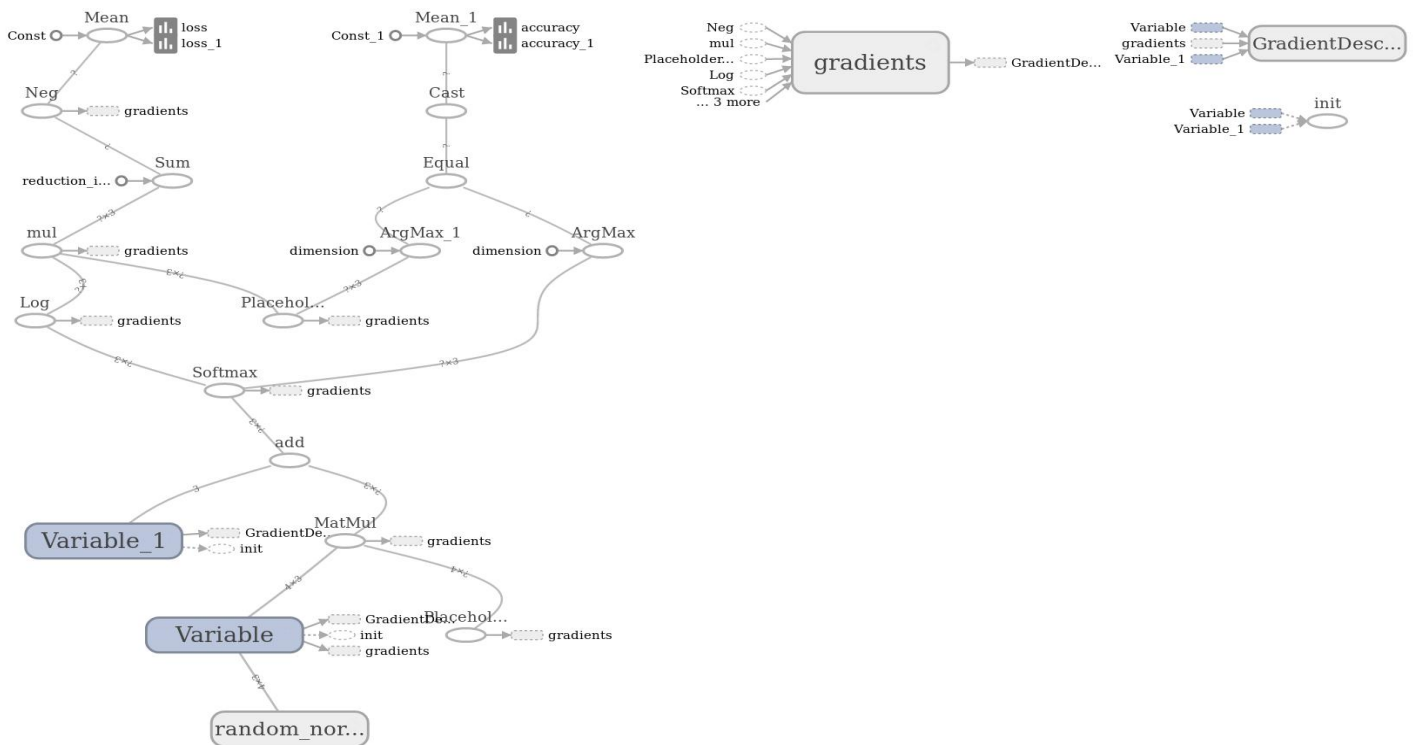


### Loss:



**Graph:**

Below is the Tensor graph of the TensorBoard.



## Exercise 2: Logistic Regression on Olivetti faces Dataset:

**Output:**

When the program first starts, the loss is big. But as we run more epochs, the cost starts to decrease and accuracy continues to increase.

```
khalid@ubuntu: ~/Documents/Homework09
khalid@ubuntu: ~/Documents/Homework09
khalid@ubuntu: ~/Documents/Homework09
Epoch: 0001 cost= 6.033115935
Epoch: 0002 cost= 5.774913931
Epoch: 0003 cost= 4.939247543
Epoch: 0004 cost= 4.149745035
Epoch: 0005 cost= 3.630291149
Epoch: 0006 cost= 3.018514380
Epoch: 0007 cost= 2.564376166
Epoch: 0008 cost= 2.158875135
Epoch: 0009 cost= 1.831405316
Epoch: 0010 cost= 1.567071119
Epoch: 0011 cost= 1.353274047
Epoch: 0012 cost= 1.181682791
Epoch: 0013 cost= 1.042426887
Epoch: 0014 cost= 0.927122563
Epoch: 0015 cost= 0.830883344
Epoch: 0016 cost= 0.750456806
Epoch: 0017 cost= 0.683003995
Epoch: 0018 cost= 0.625729771
Epoch: 0019 cost= 0.576284829
Epoch: 0020 cost= 0.533035878
Epoch: 0021 cost= 0.494845811
Epoch: 0022 cost= 0.460887884
Epoch: 0023 cost= 0.430532374
Epoch: 0024 cost= 0.403282978
Epoch: 0025 cost= 0.378736738
Epoch: 0026 cost= 0.356559435
```



```
khalid@ubuntu: ~/Documents/Homework09
khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x
Epoch: 0083 cost= 0.070576954
Epoch: 0084 cost= 0.069539082
Epoch: 0085 cost= 0.068530526
Epoch: 0086 cost= 0.067550381
Epoch: 0087 cost= 0.066597353
Epoch: 0088 cost= 0.065670340
Epoch: 0089 cost= 0.064768341
Epoch: 0090 cost= 0.063890441
Epoch: 0091 cost= 0.063035597
Epoch: 0092 cost= 0.062203003
Epoch: 0093 cost= 0.061391753
Epoch: 0094 cost= 0.060601105
Epoch: 0095 cost= 0.059830243
Epoch: 0096 cost= 0.059078541
Epoch: 0097 cost= 0.058345291
Epoch: 0098 cost= 0.057629722
Epoch: 0099 cost= 0.056931305
Epoch: 0100 cost= 0.056249437
Epoch: 0101 cost= 0.055583531
Epoch: 0102 cost= 0.054933035
Epoch: 0103 cost= 0.054297426
Epoch: 0104 cost= 0.053676238
Epoch: 0105 cost= 0.053068976
Epoch: 0106 cost= 0.052475179
Epoch: 0107 cost= 0.051894396
Epoch: 0108 cost= 0.051326266
Epoch: 0109 cost= 0.050770289
```

In the final result, I have tested the trained model on the test dataset. The Accuracy is 100%. The cost has gone down to 3.5%

```
khalid@ubuntu: ~/Documents/Homework09
khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x khalid@ubuntu: ~/Documents/Homewo... x
Epoch: 0137 cost= 0.038946033
Epoch: 0138 cost= 0.038624752
Epoch: 0139 cost= 0.038308766
Epoch: 0140 cost= 0.037997918
Epoch: 0141 cost= 0.037692074
Epoch: 0142 cost= 0.037391157
Epoch: 0143 cost= 0.037095004
Epoch: 0144 cost= 0.036803558
Epoch: 0145 cost= 0.036516647
Epoch: 0146 cost= 0.036234235
Epoch: 0147 cost= 0.035956165
Epoch: 0148 cost= 0.035682361
Epoch: 0149 cost= 0.035412695
Epoch: 0150 cost= 0.035147145

Optimization Finished!

Now Testing on Test Set

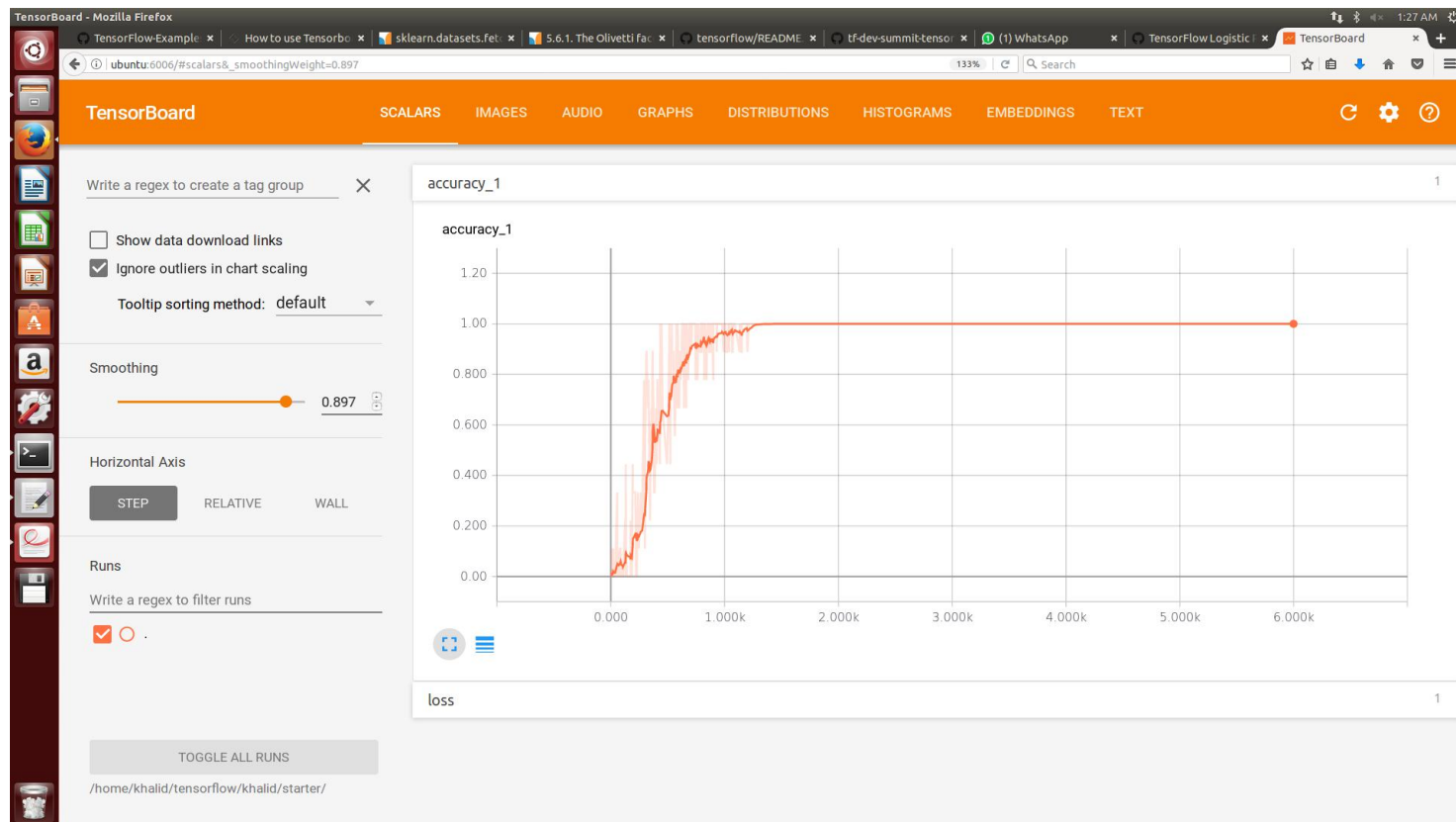
Accuracy on Test Set is : 1.0

khalid@ubuntu:~/Documents/Homework09$
```

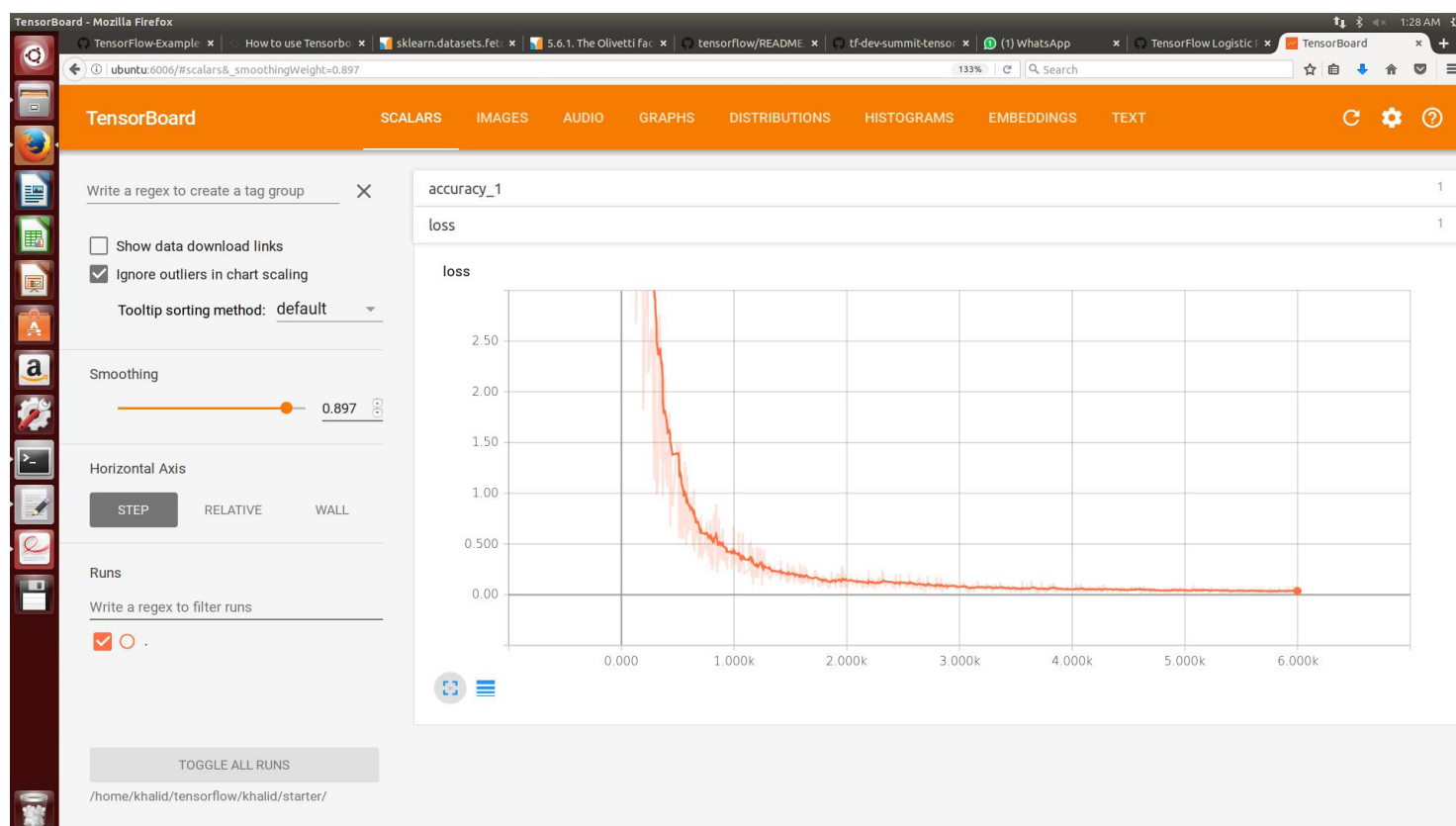
## Scalar Values:

Below are the scalar values for Accuracy and Loss in the TensorBoard.

### Accuracy:



### Loss:

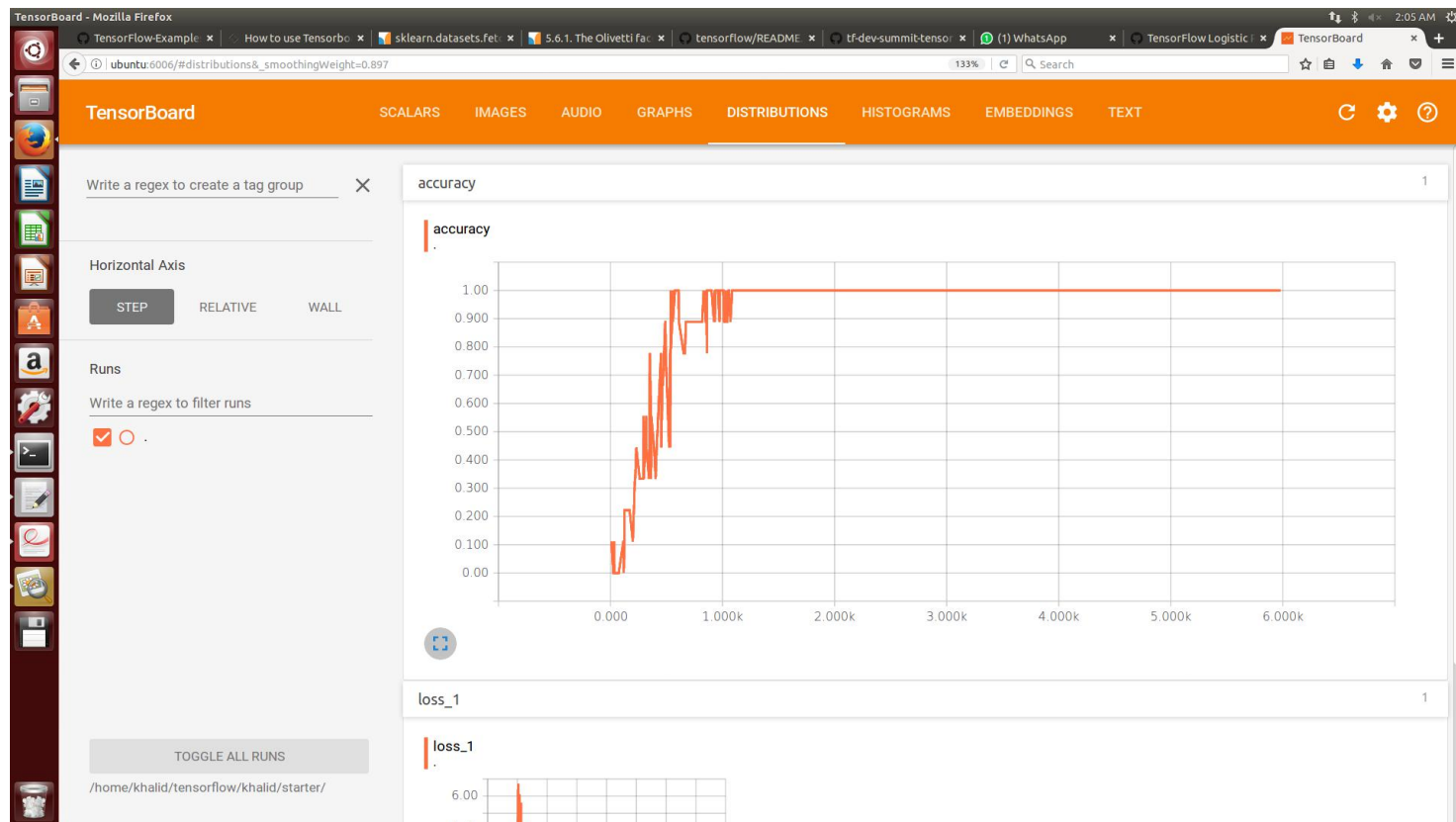




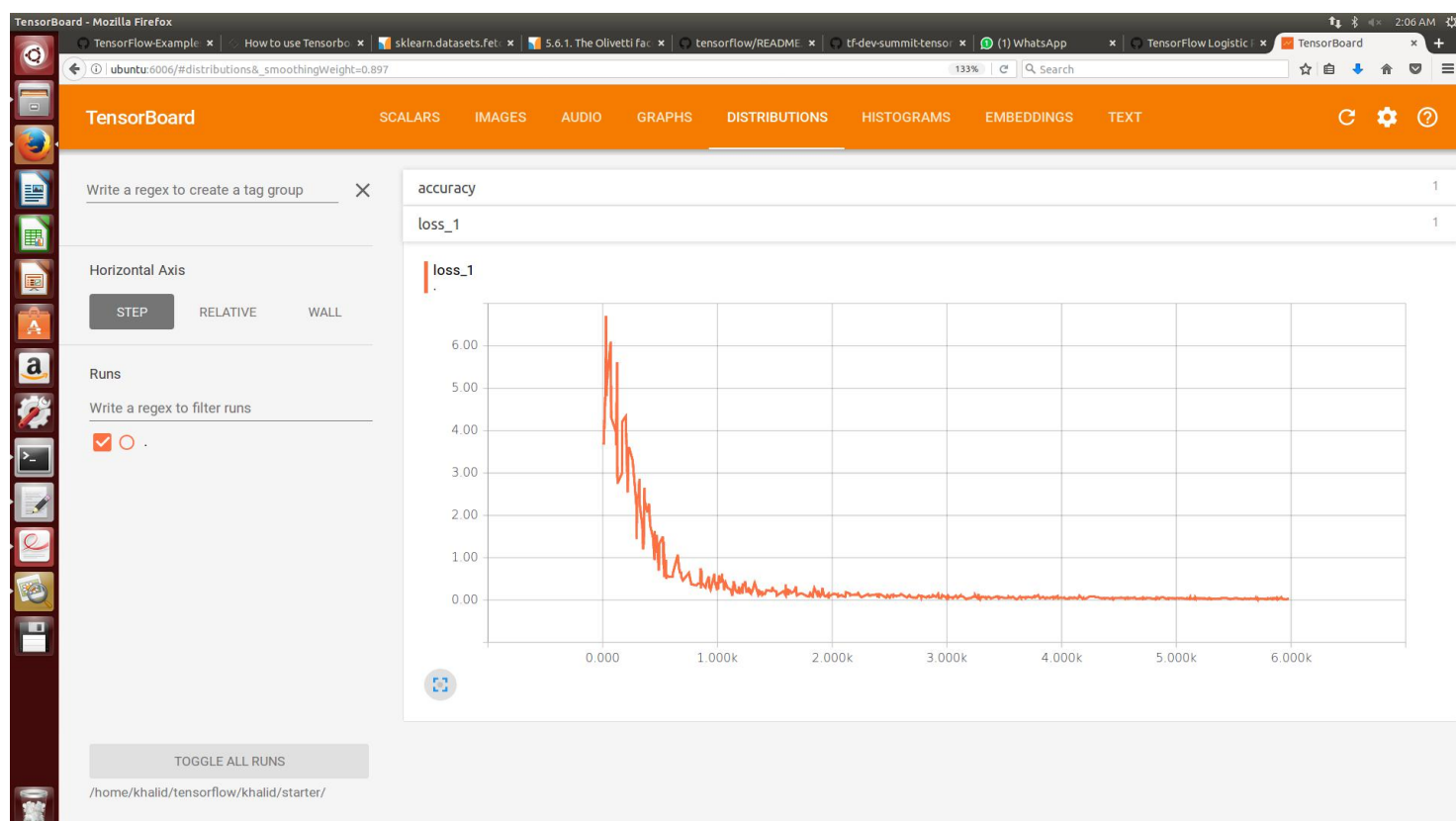
## Distributions:

Below are distribution values for Accuracy and Loss respectively.

## Accuracy:



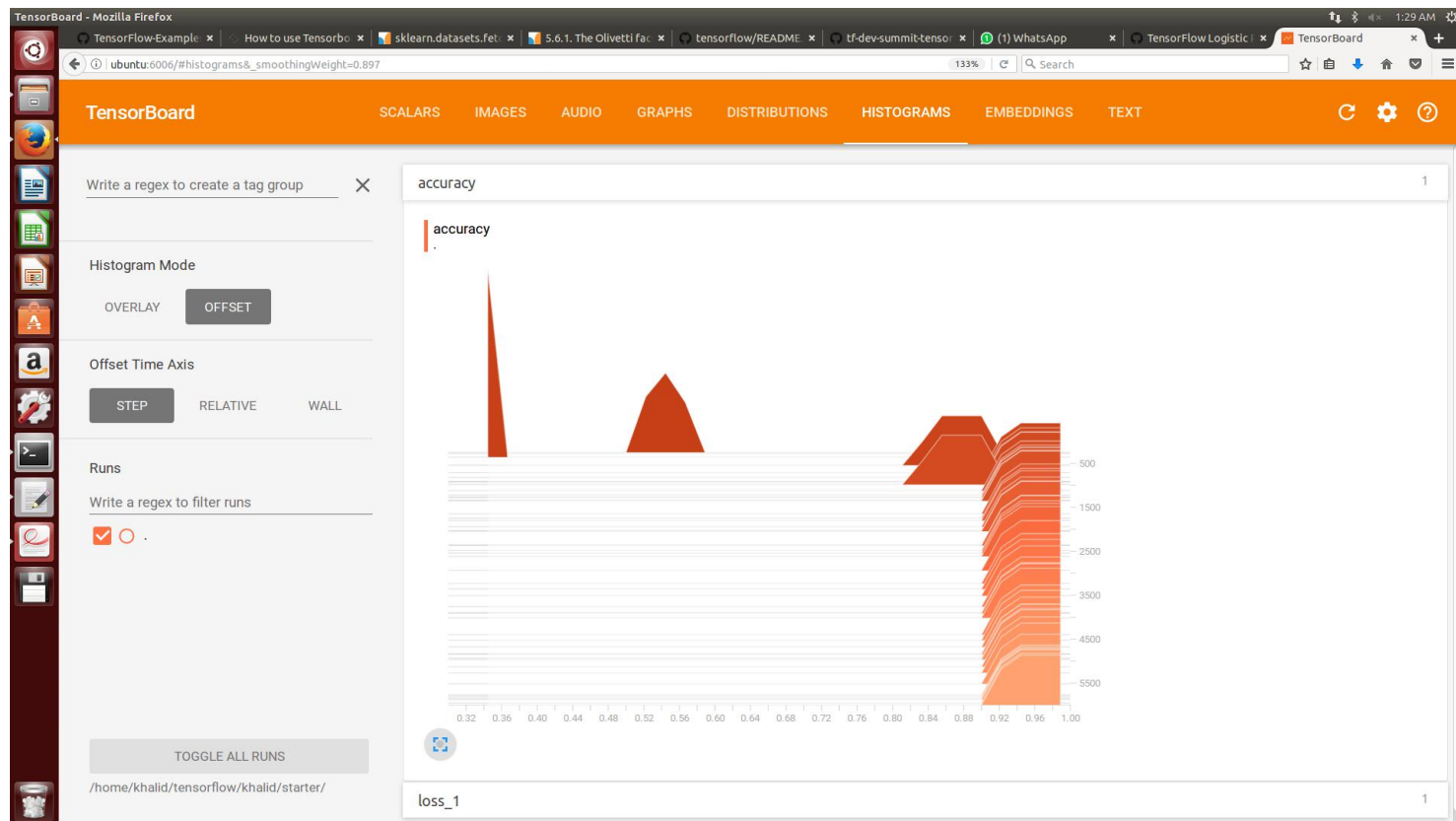
## Loss:



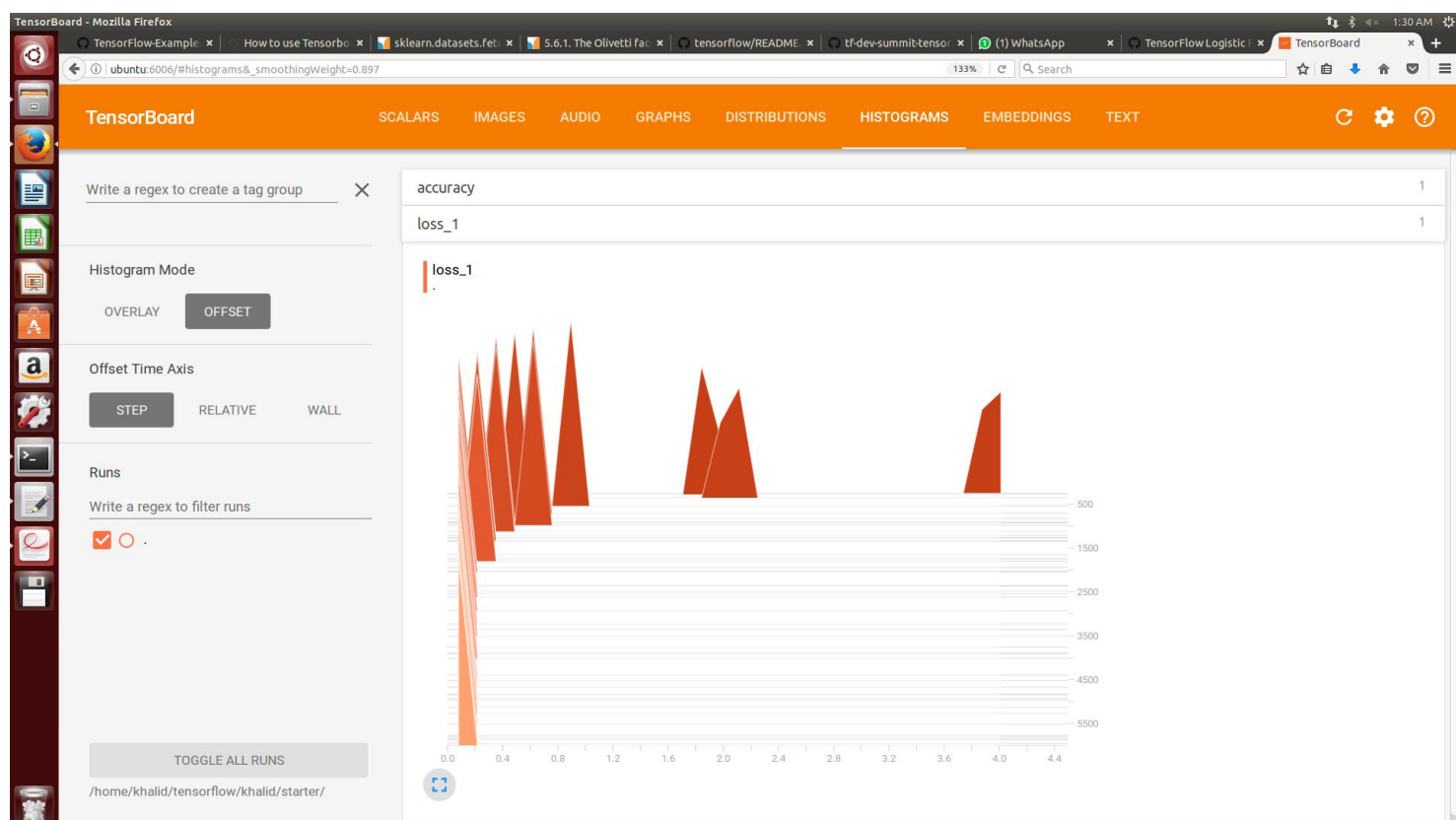
## Histograms:

Below are histograms for Accuracy and Loss.

### Accuracy:



### Loss:



## Graph:

Below is the Tensor graph of the TensorBoard.

