Experiments

To prove our hypothesis we should perform some experiments. In these experiments, the model first runs without filter and with filters on the set of 1560 images and then the same set of experiments will perform on 1060 images to see the result of training loss with filter and without filters.  
  
Setup for Experiment 1 :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model is that the total parameters of the model are 8,047,347. From which the trainable parameters are 8,011,251 and non-train able parameters are 36,096.  
  
The number of EPOCS is 200. The train Batch size is 32 and Train Steps per EPOCH are 60  
  
Result and Summary of Experiment 1

The model takes about 6331 seconds to complete the 200 EPOCH. The training loss is 10.3086 and the validation loss is 555.87. The difference between the training loss and validation loss is 545.56.  
This is the sign that the model is underfit and it is because of less trainable parameters and fewer data. if you see the graph shows that the number of EPOCHS should be more then 200 and data should be more. Moreover, when the trainable parameters would be more and when we will run that the training loss will become less and the difference between training loss and validation loss will also be reduced

A close up of a map

Description automatically generated

Setup for Experiment 2 With Mean Filter :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

In the process of data pre-processing the mean filter is applied to all train data which is about 1248 images in total. The mean filter is applied by using OPEN CV-library and then use the function of the blur. This function is called by cv2.blur(img,(5\*5). This function has two parameters one is taking an image and the other parameter is the size of the kernel. I take the size of 5 for the kernel for this experiment.

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model are that the total parameters of the model are 8,047,347. From which the trainable parameters are 8,011,251 and non-train able parameters are 36,096.  
  
The number of EPOCS is 200. The train Batch size is 32 and Train Steps per EPOCH are 60

Result and Summary of Experiment 2 with mean filter

The model takes about 6000 seconds to complete the 200 EPOCH. The training loss is 3.2645 and the validation loss is 606.614. The difference between the training loss and validation loss is 603.60

The difference of time between Experiment 1 and Experiment 2 is of 331 seconds and as you can see that by applying the mean filter the value of the training loss is less as compared to the value which we get in the experiment was 10.30. The difference between these two values is 7.30 which is very good. This shows that by applying mean filter the training loss could be less and the accuracy of the model can be good but on the other hand the difference between training loss and the validation loss is 603.60 which shows that the model is underfit and it is because of less trainable parameters and fewer data. if you see the graph shows that the number of EPOCHS should be more then 200 and data should be more. Moreover when the trainable parameters would be more. and when we will run that on the training loss will become less and the difference between training loss and validation loss will also be reduced

A picture containing screenshot

Description automatically generated

Setup for Experiment 3 With Median Filter :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

In the process of data pre-processing the median filter is applied to all train data which is about 1248 images in total. The mean filter is applied by using OPEN CV-library and then use the function of the blur. This function is called by cv2.medianblur(img, 21). This function has two parameters one is taking the image and the other parameter is the size of the kernel. The size of the kernel must be an odd integer.I take the size of 21 for the kernel for this experiment.

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model are that the total parameters of the model are 8,047,347 . From which the trainable parameters are 8,011,251 and nontrain able parameters are 36,096.  
  
The number of EPOCS is 200. The train Batch size is 32 and Train Steps per EPOCH are 60

Result and Summary of Experiment 3 with a median filter

The model takes about 12 243 seconds to complete the 200 EPOCH. The training loss is 4.2998 and the validation loss is 856.74. The difference between the training loss and validation loss is 852.41

This experiments take more time as compared to Experiment1 and experiment 2. The difference of time between experiment3 and experiment 1 is 5921 seconds and the difference of time between experiment 2 and experiment3 is 5581 seconds which is very high when we apply the median filter.

The training loss of the median filter is less as compared to experiment 1. The difference value between them is 6.09. interestingly the difference value of training loss between experiment 2 and experiment 3 is about 1.02. This shows that the median filter help in reducing the value of the training loss but it takes more time as compared to the mean filter and without filter .but, on the other hand, the difference between training loss and the validation loss is 852.60 which shows that the model is under fit and it is because of less trainable parameters and less data. if you see the graph shows that the number of EPOCHS should be more then 200 and data should be more. Moreover when the trainable parameters would be more and when we will run that on the training loss will become less and the difference between training loss and validation loss will also be reduced

A picture containing screenshot

Description automatically generated

Setup for Experiment 4 With Gaussian Filter :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

In the process of data pre-processing the Gaussian filter is applied to all train data which is about 1248 images in total. The mean filter is applied by using OPEN CV library and then use the function of the blur. This function is called by cv2.Gaussian blur(img, (21,21),0). This function has three parameters one is taking an image and the other parameter is the size of the kernel. The size of the kernel must be a positive integer.I take the size of 21 for the kernel for this experiment. The last parameter is about the sigma value if it is not given the filter calculate it from the kernel size

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model is that the total parameters of the model are 8,047,347 . From which the trainable parameters are 8,011,251 and non-train able parameters are 36,096.  
  
The number of EPOCS is 200. The train Batch size is 32 and Train Steps per EPOCH are 60

Result and Summary of Experiment 4 with Gaussian filter

The model takes about 10600 seconds to complete the 200 EPOCH. The training loss is 1.5049 and the validation loss is 741.320. The difference between the training loss and validation loss is 739.80

This experiments take more time as compared to Experiment1 experiment 2 but takes less time from experiment 3. The difference of time between experiment4 and experiment 1 is 4296 seconds and difference of time between experiment 3 and experiment4 is 1643 seconds

The training loss of the gaussian filter is less as compared to all the above 3 three experiments. The difference between the value of training loss of experiment 1 2, and 3 are 8.8, 1.7 and 2.79 respectively. This shows that the gaussian blur filter gives a good result as compared to the mean median and without a filter . It takes more time then experiment 1 and experiment2 but the training loss value is lowest as compared to all experiments.

.but on the other hand the difference between training loss and the validation loss is 739.80 which shows that the model is underfit and it is because of less trainable parameters and fewer data. if you see the graph shows that the number of EPOCHS should be more then 200 and data should be more. Moreover when the trainable parameters would be more and when we will run that on the training loss

A close up of a logo

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Setup for Experiment 5 With biletral Filter :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

In the process of data pre-processing the Gaussian filter is applied to all train data which is about 1248 images in total. The mean filter is applied by using the OPEN CV-library and then use the function of the blur. This function is called by cv2.Gaussian blur(img, (21,21),0). This function has three parameters one is taking the image and the other parameter is the size of the kernel. The size of the kernel must be a positive integer.I take the size of 21 for the kernel for this experiment. The last parameter is about the sigma value if it is not given the filter calculate it from the kernel size

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to perform the experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model is that the total parameters of the model are 8,047,347. From which the trainable parameters are 8,011,251 and non-train able parameters are 36,096.  
  
The number of EPOCS are 200 . The train Batch size is 32 and Train Steps per EPOCH are 60

Result and Summary of Experiment 5 with biltearl filter

The model takes about 10600 seconds to complete the 200 EPOCH. The training loss is 1.5049 and the validation loss is 741.320. The difference between the training loss and validation loss is 739.80

This experiments take more time as compared to Experiment1 experiment 2 but takes less time from experiment 3. The difference of time between experiment4 and experiment 1 is 4296 seconds and difference of time between experiment 3 and experiment4 is 1643 seconds

The training loss of gaussian filter is less as compared to all above 3 three experiments . The difference between the value of training loss of experiment 1 2 , and 3 are 8.8, 1.7 and 2.79 respectively . This shows that the gaussian blur filter gives good result as compared to the mean median and with out filter . It take more time then experiment 1 and experiment2 but the training loss value is lowest as compered to all experiments .

.but on the other hand the difference between training loss and the validation loss is 739.80 which shows that the model is under fit and it is because of less train able parameters and less data . if you see the graph is shows that the number of EPOCHS should be more then 200 and data should be more . Moreover when the trainable parameters would be more and when we will run that on the training loss

Setup for Experiment 6 :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model is that the total parameters of the model are 8,047,347. From which the trainable parameters are 8,011,251 and non-train able parameters are 36,096.  
  
The number of EPOCS is 200. The train Batch size is 32 and Train Steps per EPOCH are 60  
  
Result and Summary of Experiment 6

The model takes about 6331 seconds to complete the 200 EPOCH. The training loss is 10.3086 and the validation loss is 555.87. The difference between the training loss and validation loss is 545.56.  
This is the sign that the model is underfit and it is because of less trainable parameters and fewer data. if you see the graph shows that the number of EPOCHS should be more then 200 and data should be more. Moreover, when the trainable parameters would be more and when we will run that the training loss will become less and the difference between training loss and validation loss will also be reduced

Setup for Experiment 7 With Mean Filter :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

In the process of data pre-processing the mean filter is applied to all train data which is about 1248 images in total. The mean filter is applied by using OPEN CV-library and then use the function of the blur. This function is called by cv2.blur(img,(5\*5). This function has two parameters one is taking an image and the other parameter is the size of the kernel. I take the size of 5 for the kernel for this experiment.

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model are that the total parameters of the model are 8,047,347. From which the trainable parameters are 8,011,251 and non-train able parameters are 36,096.  
  
The number of EPOCS is 200. The train Batch size is 32 and Train Steps per EPOCH are 60

Result and Summary of Experiment 7 with mean filter

The model takes about 6000 seconds to complete the 200 EPOCH. The training loss is 3.2645 and the validation loss is 606.614. The difference between the training loss and validation loss is 603.60

The difference of time between Experiment 1 and Experiment 2 is of 331 seconds and as you can see that by applying the mean filter the value of the training loss is less as compared to the value which we get in the experiment was 10.30. The difference between these two values is 7.30 which is very good. This shows that by applying mean filter the training loss could be less and the accuracy of the model can be good but on the other hand the difference between training loss and the validation loss is 603.60 which shows that the model is underfit and it is because of less trainable parameters and fewer data. if you see the graph shows that the number of EPOCHS should be more then 200 and data should be more. Moreover when the trainable parameters would be more. and when we will run that on the training loss will become less and the difference between training loss and validation loss will also be reduced

Setup for Experiment 8 With Median Filter :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

In the process of data pre-processing the median filter is applied to all train data which is about 1248 images in total. The mean filter is applied by using OPEN CV-library and then use the function of the blur. This function is called by cv2.medianblur(img, 21). This function has two parameters one is taking the image and the other parameter is the size of the kernel. The size of the kernel must be an odd integer.I take the size of 21 for the kernel for this experiment.

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model are that the total parameters of the model are 8,047,347 . From which the trainable parameters are 8,011,251 and nontrain able parameters are 36,096.  
  
The number of EPOCS is 200. The train Batch size is 32 and Train Steps per EPOCH are 60

Result and Summary of Experiment 8 with a median filter

The model takes about 12 243 seconds to complete the 200 EPOCH. The training loss is 4.2998 and the validation loss is 856.74. The difference between the training loss and validation loss is 852.41

This experiments take more time as compared to Experiment1 and experiment 2. The difference of time between experiment3 and experiment 1 is 5921 seconds and the difference of time between experiment 2 and experiment3 is 5581 seconds which is very high when we apply the median filter.

The training loss of the median filter is less as compared to experiment 1. The difference value between them is 6.09. interestingly the difference value of training loss between experiment 2 and experiment 3 is about 1.02. This shows that the median filter help in reducing the value of the training loss but it takes more time as compared to the mean filter and without filter .but, on the other hand, the difference between training loss and the validation loss is 852.60 which shows that the model is under fit and it is because of less trainable parameters and less data. if you see the graph shows that the number of EPOCHS should be more then 200 and data should be more. Moreover when the trainable parameters would be more and when we will run that on the training loss will become less and the difference between training loss and validation loss will also be reduced

Setup for Experiment 9 With Gaussian Filter :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

In the process of data pre-processing the Gaussian filter is applied to all train data which is about 1248 images in total. The mean filter is applied by using OPEN CV library and then use the function of the blur. This function is called by cv2.Gaussian blur(img, (21,21),0). This function has three parameters one is taking an image and the other parameter is the size of the kernel. The size of the kernel must be a positive integer.I take the size of 21 for the kernel for this experiment. The last parameter is about the sigma value if it is not given the filter calculate it from the kernel size

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model is that the total parameters of the model are 8,047,347 . From which the trainable parameters are 8,011,251 and non-train able parameters are 36,096.  
  
The number of EPOCS is 200. The train Batch size is 32 and Train Steps per EPOCH are 60

Result and Summary of Experiment 9 with Gaussian filter

The model takes about 10600 seconds to complete the 200 EPOCH. The training loss is 1.5049 and the validation loss is 741.320. The difference between the training loss and validation loss is 739.80

This experiments take more time as compared to Experiment1 experiment 2 but takes less time from experiment 3. The difference of time between experiment4 and experiment 1 is 4296 seconds and difference of time between experiment 3 and experiment4 is 1643 seconds

The training loss of the gaussian filter is less as compared to all the above 3 three experiments. The difference between the value of training loss of experiment 1 2, and 3 are 8.8, 1.7 and 2.79 respectively. This shows that the gaussian blur filter gives a good result as compared to the mean median and without a filter . It takes more time then experiment 1 and experiment2 but the training loss value is lowest as compared to all experiments.

.but on the other hand the difference between training loss and the validation loss is 739.80 which shows that the model is underfit and it is because of less trainable parameters and fewer data. if you see the graph shows that the number of EPOCHS should be more then 200 and data should be more. Moreover when the trainable parameters would be more and when we will run that on the training loss

Setup for Experiment 10 With bilateral Filter :

The total amount of images we are using for this experiment are 1560 images. Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total.

In the process of data pre-processing the Gaussian filter is applied to all train data which is about 1248 images in total. The mean filter is applied by using the OPEN CV-library and then use the function of the blur. This function is called by cv2.Gaussian blur(img, (21,21),0). This function has three parameters one is taking the image and the other parameter is the size of the kernel. The size of the kernel must be a positive integer.I take the size of 21 for the kernel for this experiment. The last parameter is about the sigma value if it is not given the filter calculate it from the kernel size

The Model will run on the Google Colab which provides an online virtual machine with more computational powers. It will use the Tesla K80 GPU to perform the experiment.

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model is that the total parameters of the model are 8,047,347. From which the trainable parameters are 8,011,251 and non-train able parameters are 36,096.  
  
The number of EPOCS are 200 . The train Batch size is 32 and Train Steps per EPOCH are 60

Result and Summary of Experiment 5 with bilateral filter

The model takes about 10600 seconds to complete the 200 EPOCH. The training loss is 1.5049 and the validation loss is 741.320. The difference between the training loss and validation loss is 739.80

This experiments take more time as compared to Experiment1 experiment 2 but takes less time from experiment 3. The difference of time between experiment4 and experiment 1 is 4296 seconds and difference of time between experiment 3 and experiment4 is 1643 seconds

The training loss of gaussian filter is less as compared to all above 3 three experiments . The difference between the value of training loss of experiment 1 2 , and 3 are 8.8, 1.7 and 2.79 respectively . This shows that the gaussian blur filter gives good result as compared to the mean median and with out filter . It take more time then experiment 1 and experiment2 but the training loss value is lowest as compered to all experiments .

.but on the other hand the difference between training loss and the validation loss is 739.80 which shows that the model is under fit and it is because of less train able parameters and less data . if you see the graph is shows that the number of EPOCHS should be more then 200 and data should be more . Moreover when the trainable parameters would be more and when we will run that on the training loss

Summary of 1 to 5 experiments

In these experiments The total amount of images we are using for this experiment are 1560 images . Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model is that the total parameters of the model are 8,047,347 . From which the trainable parameters are 8,011,251 and non train able parameters are 36,096.

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| --- | --- | --- | --- | --- |
| Type | Training loss | Validation loss | Difference of loss | Total time |
| With out filter | 10.308 | 555.87 | 545.4 | 6331 seconds |
| Mean Filter | 3.26 | 606.61 | 603.41 | 6000 seconds |
| Median filter | 4.29 | 856.74 | 853.48 | 12243 seconds |
| Gaussian filter | 1.50 | 741.32 | 739.82 | 10600 seconds |
| Bilateral filter |  |  |  |  |

Summary of 6 to 10 experiments

In these experiments The total amount of images we are using for this experiment are 1560 images . Half of them are classic images which are 780 in total and half of them are thermal images which are 780 in total

The ratio of Train data is 80 percent from the whole data set which are 1248 images and 20 percent of the data is validation data or test data which is about 312 in total

The Back Bone of the architecture is MOBLIENETV2 and details about the parameters of the model is that the total parameters of the model are 8,047,347 . From which the trainable parameters are 8,011,251 and non train able parameters are 36,096.

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| --- | --- | --- | --- | --- |
| Type | Training loss | Validation loss | Difference of loss | Total time |
| With out filter | 10.308 | 555.87 | 545.4 | 6331 seconds |
| Mean Filter | 3.26 | 606.61 | 603.41 | 6000 seconds |
| Median filter | 4.29 | 856.74 | 853.48 | 12243 seconds |
| Gaussian filter | 1.50 | 741.32 | 739.82 | 10600 seconds |
| Bilateral filter |  |  |  |  |