

Flower Recognition

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Introduction

FATAL ATTRACTION - THE DANGER LIST			
Asiatic lily	Chrysanthemum	Geranium	Marigold
Asparagus fern	Daisy	Grape plant	Nerium oleander
Begonia	Daffodil bulbs	Green seed potatoes	Peony
Box hedging	Dahlia (left)	Hydrangea (below)	Plantain lily
Calla lily	Delphinium	Ivy	Poppy (right)
Cherry laurel	Elderberry	Lobelia	Verbena
Clematis	Eucalyptus	Lupin	Wisteria
Cordyline	Fern	Tomato plant	Yew tree
	Foxglove		

Recognize/identify the type of the flower given in the input image.

User-friendly front end integrated with 5 fully trained models

Resultant prediction labels from the models are displayed on the front end.

Motivation

Certain flowering plants release enzymes that trigger allergic reaction in humans.

They also attract poisonous bugs that could attack the human in the vicinity of the plant.


Helps in identifying and relating new plants to other identified plant species- this could contribute to research efforts in the fields of pollination, cloning, medicine, evolution study, plant science and lead to breakthroughs.

Goals

- GUI to enable the user to upload an image.
- Fully trained model that takes in vectorized images and predicts the label.
- GUI to display the predictions and metrics of AWS Rekognition API and the trained models
- Three different Convolutional neural networks trained on image features like Gaussian, Sharp and Gabor respectively.
- A concatenated model that is composed of all the above 3 CNN models.

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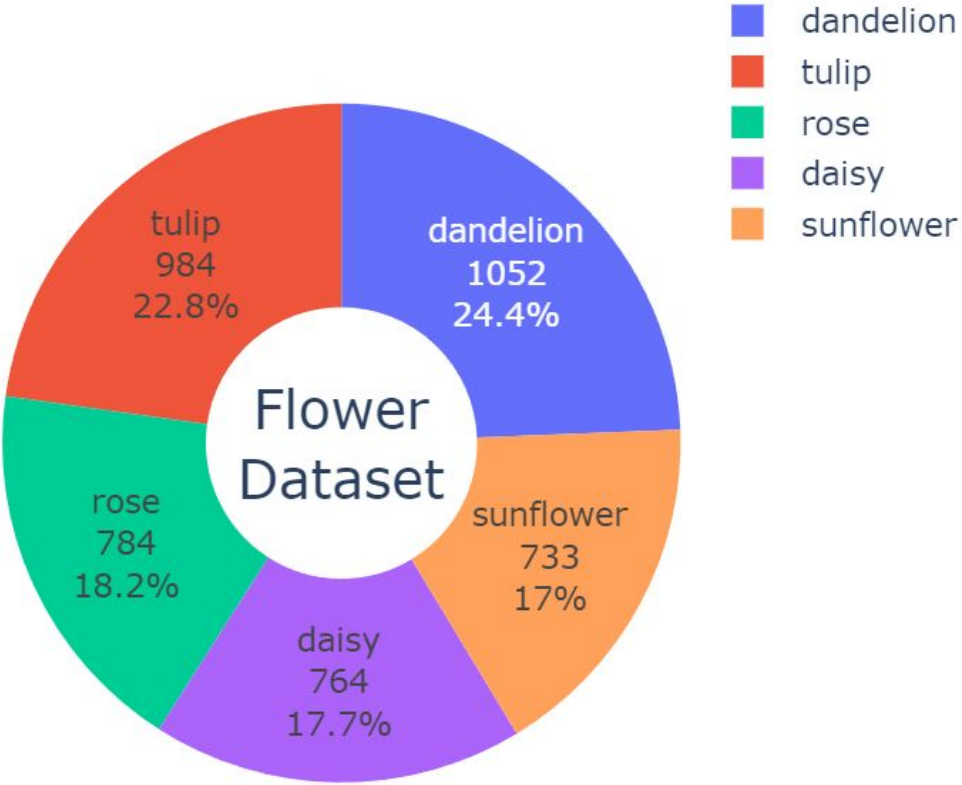
Uploaded Image



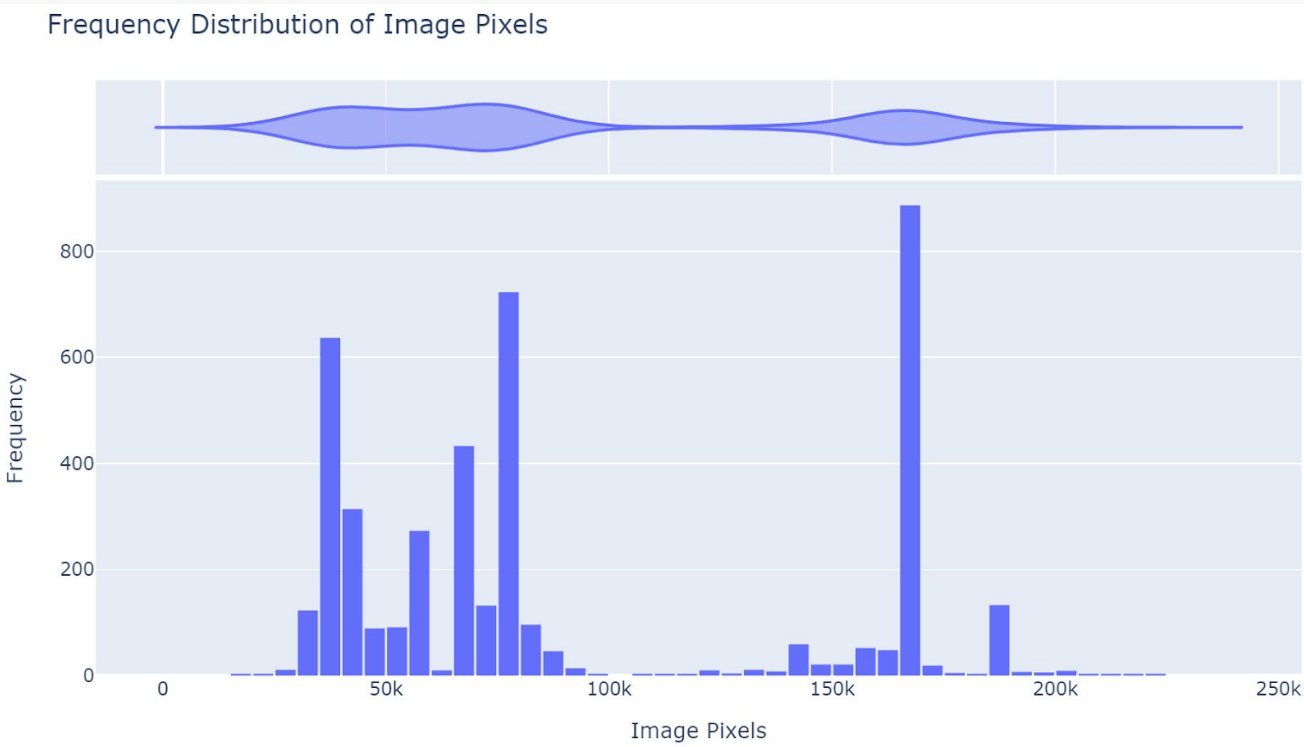
[Go Back](#)

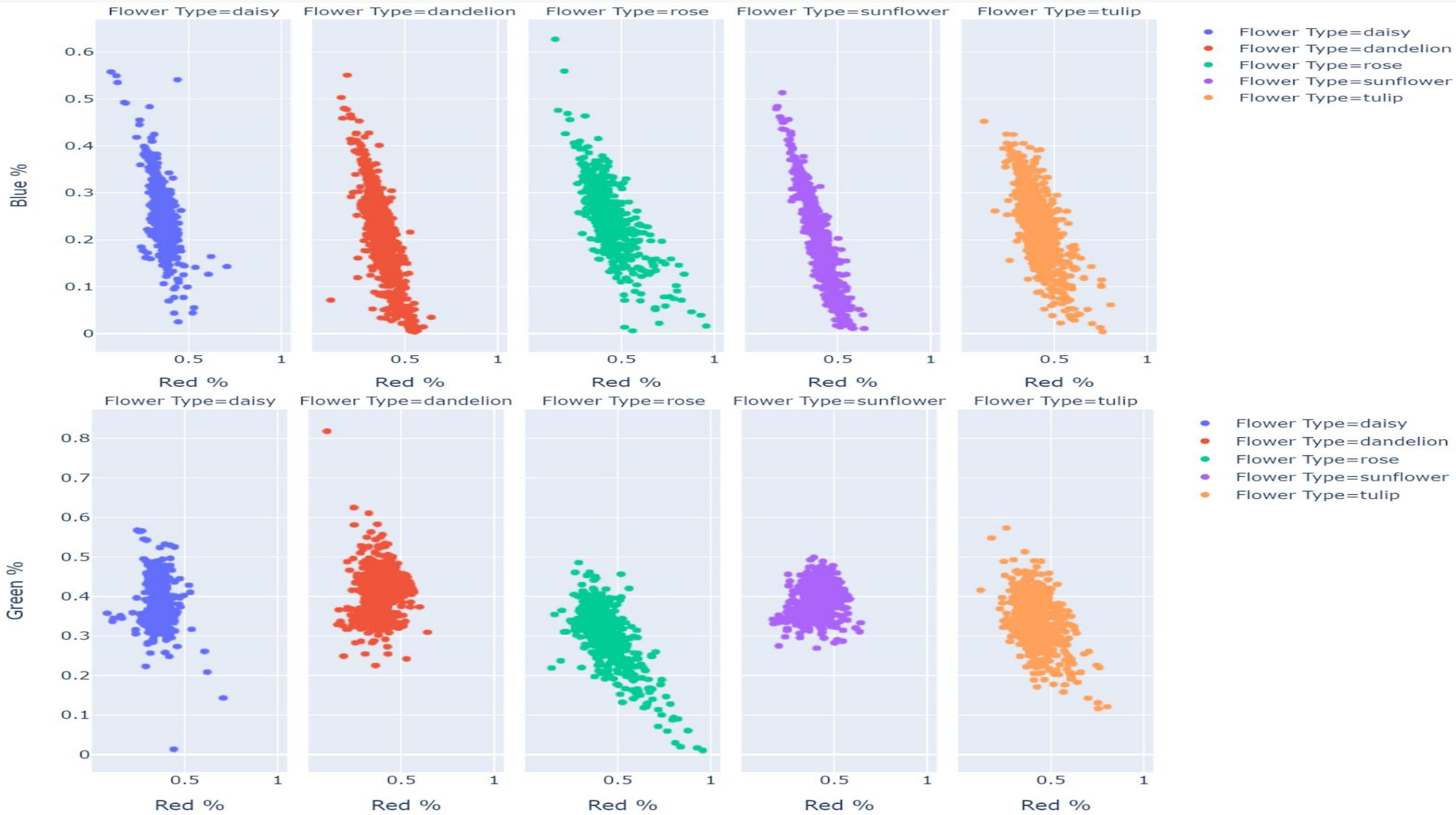
Model	Predicted Flower Class	Probability
Gabor Filter CNN	TO DO	TO DO
Gaussian Filter CNN	TO DO	TO DO
Sharpening Filter CNN	TO DO	TO DO
Amazon Rekognition API	Sunflower	0.960577

Flower Data



	Range	Min	Max	Mean	Median	Standard Deviation
Image Width	890.000000	134.000000	1024.000000	338.379893	320.000000	119.067232
Image Height	362.000000	80.000000	442.000000	253.073662	240.000000	61.558205
Image Pixels	201800.000000	19200.000000	221000.000000	91445.254112	76480.000000	52130.492116
Red %	0.888605	0.084733	0.973338	0.395124	0.377033	0.079271
Green %	0.807317	0.010713	0.818030	0.358717	0.355041	0.060148
Blue %	0.623759	0.003307	0.627066	0.246159	0.260725	0.083258



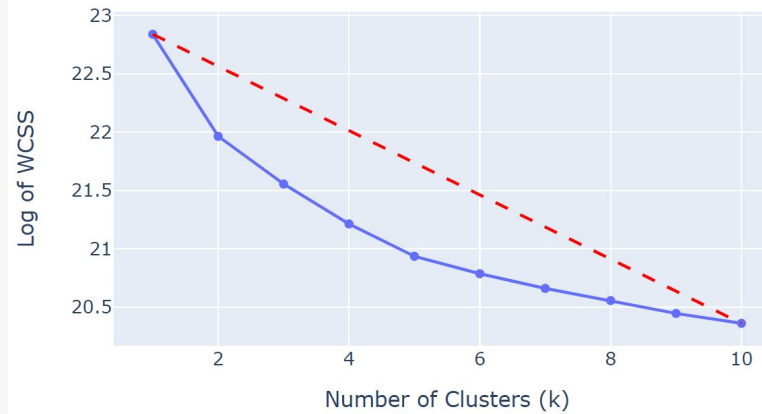


WCSS

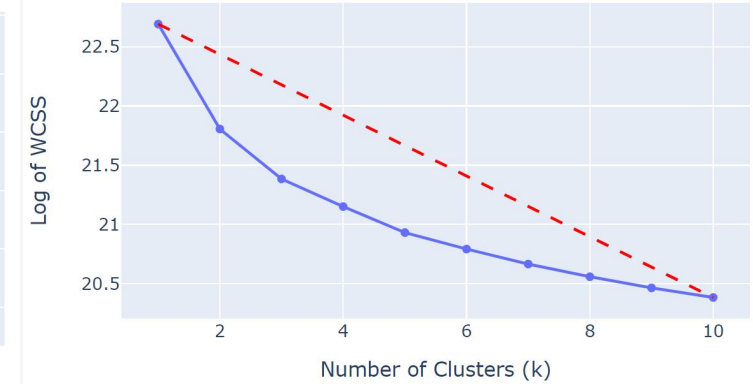
VS

No of clusters

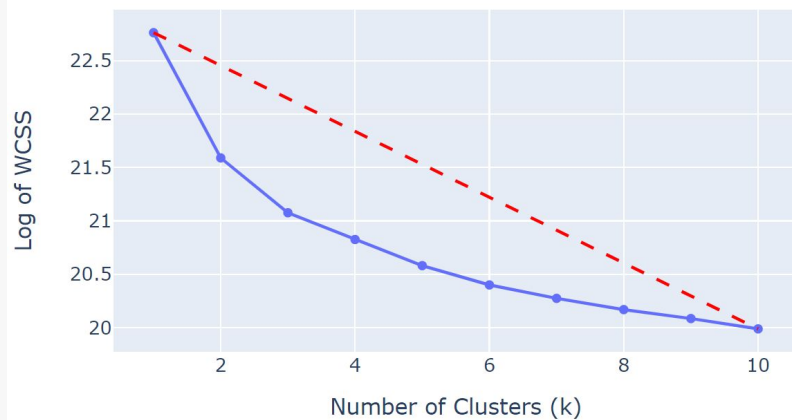
Flower Type: dandelion



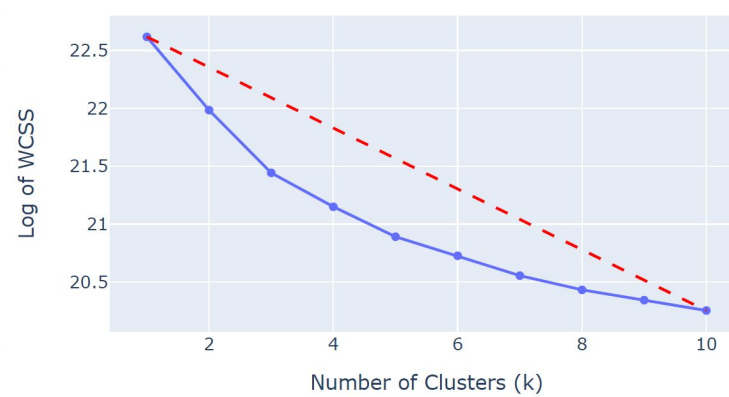
Flower Type: rose



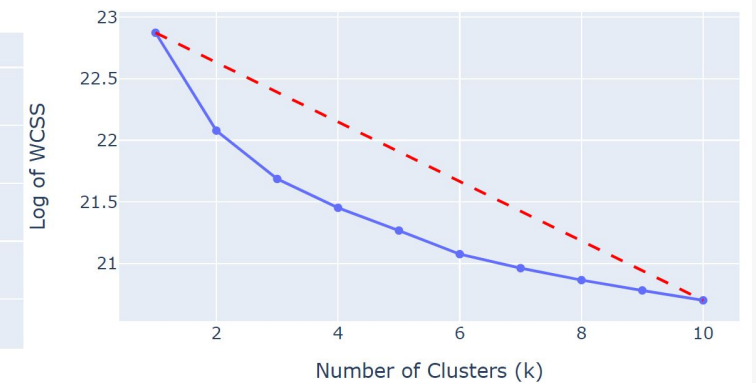
Flower Type: daisy



Flower Type: sunflower



Flower Type: tulip



Dominant Colours for each category

dandelion



daisy



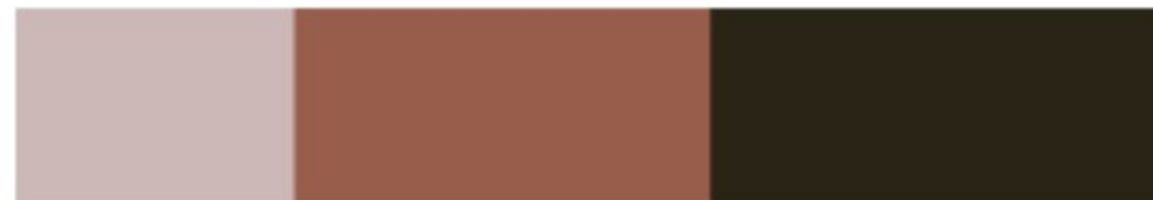
sunflower



tulip



rose



Feature Extraction

Image after applying Gaussian filters

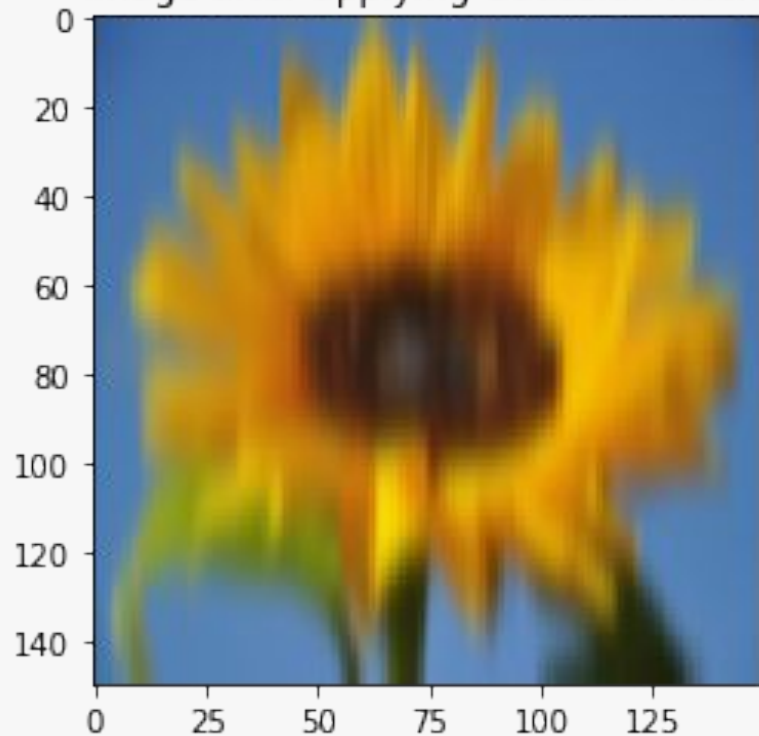


Image after applying Gabor filters

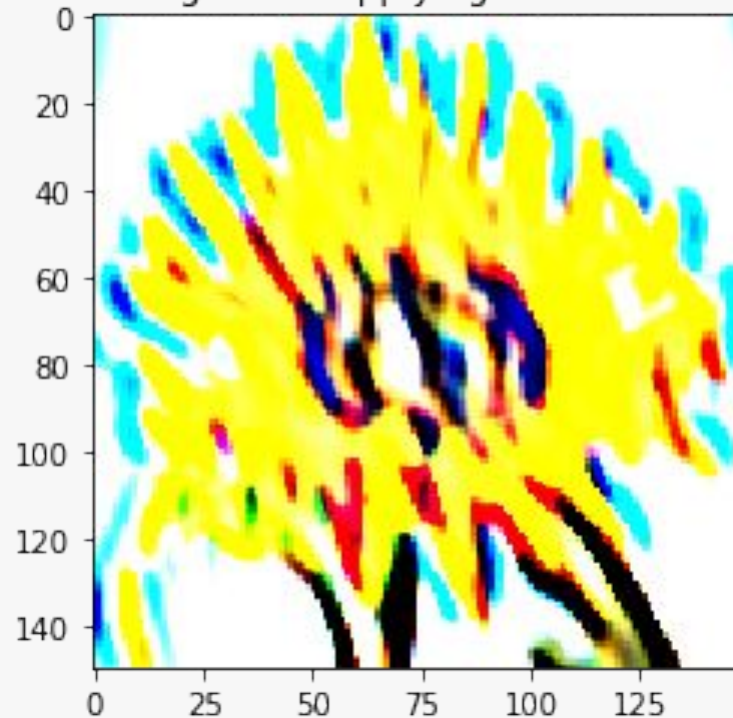
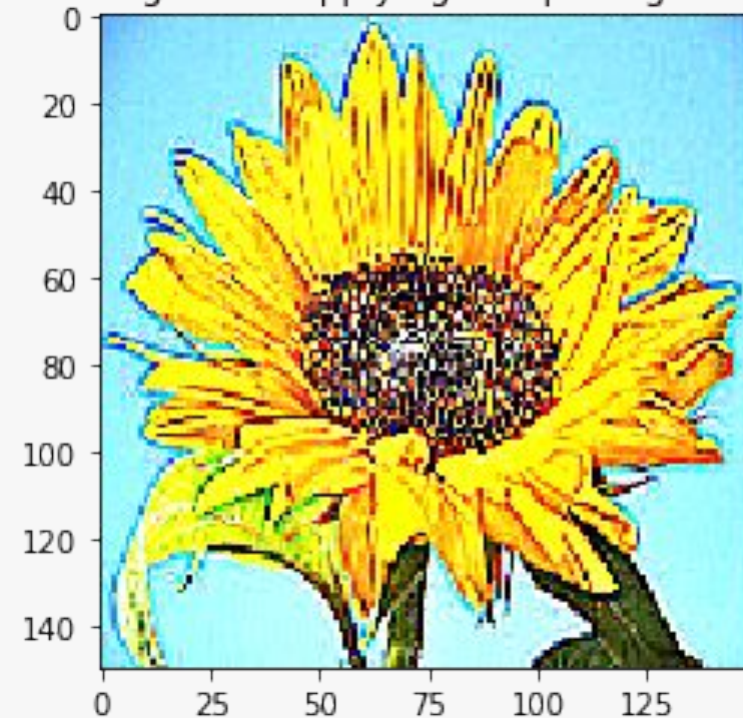
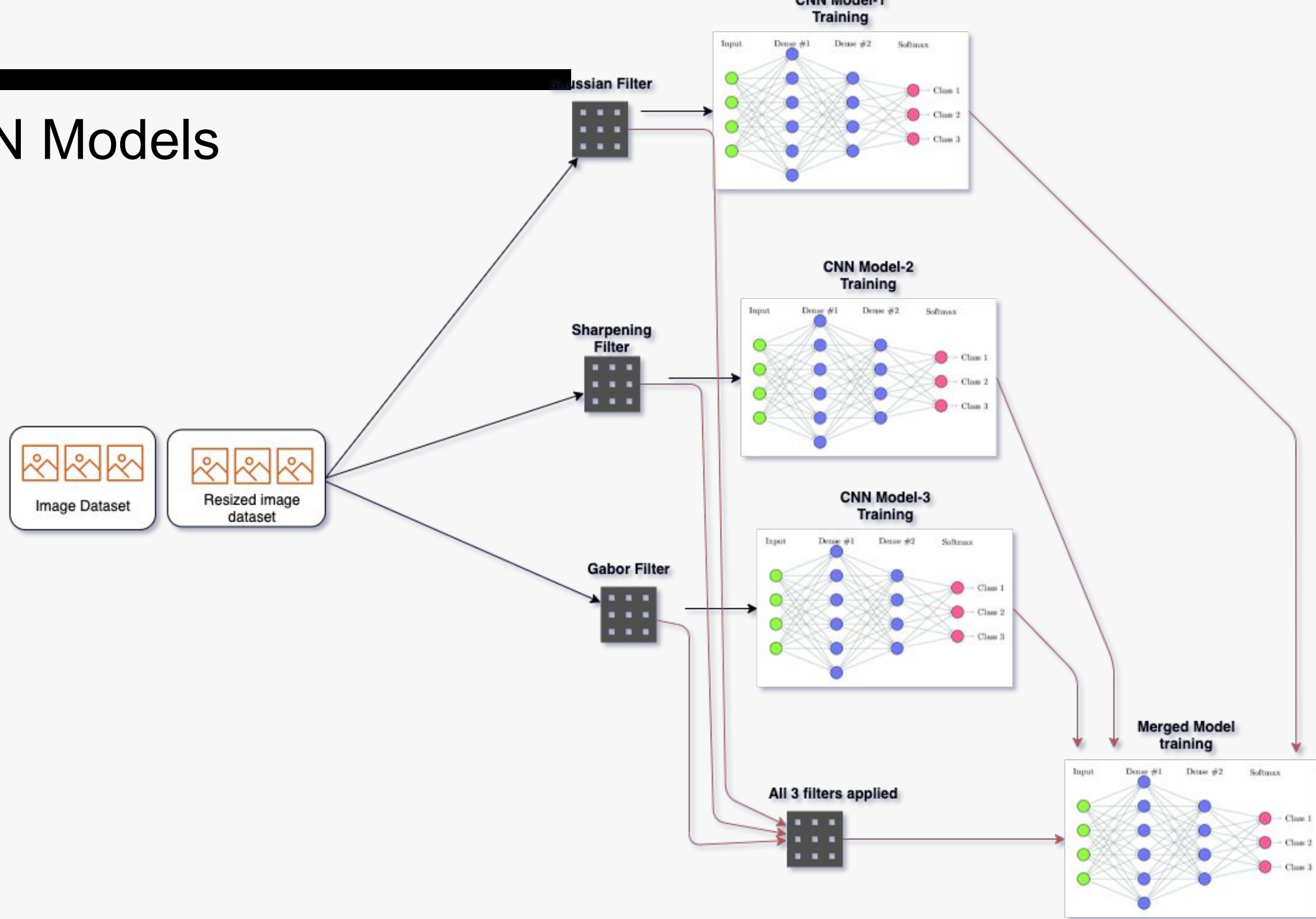


Image after applying sharpening filters



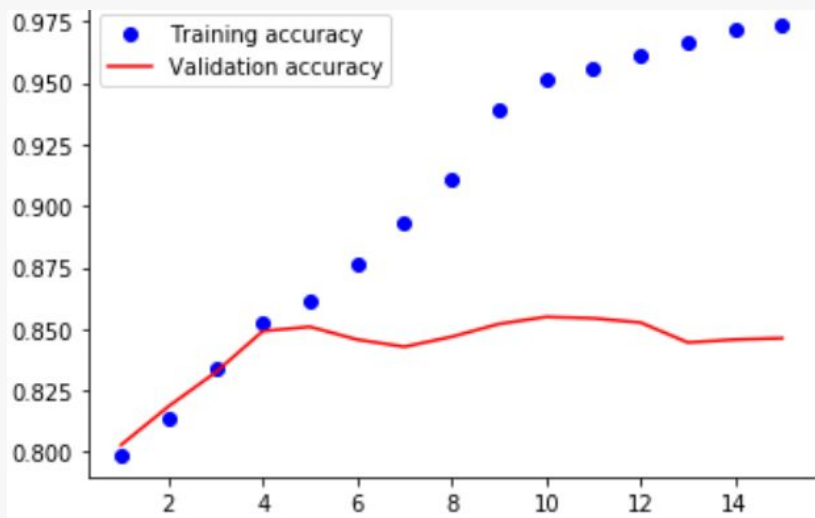
CNN Models



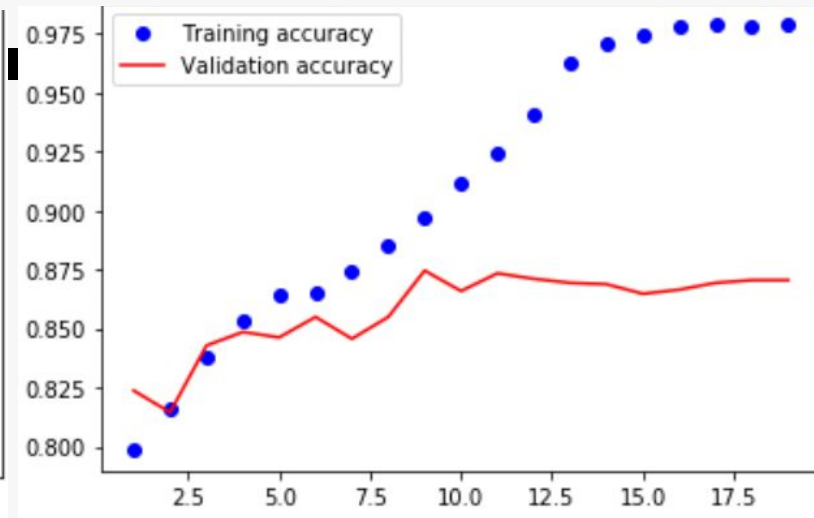
CNN with Keras

```
input1 = Input(shape=(size, size, 3))
x = Conv2D(filters = 32, kernel_size = 5, padding = 'same', activation = 'relu')(input1)
x = MaxPooling2D((2, 2))(x)
x = Conv2D(filters = 64, kernel_size = 3, padding = 'same', activation = 'relu')(x)
x = MaxPooling2D((2, 2), strides=(2,2))(x)
x = Conv2D(filters = 96, kernel_size = 3, padding = 'same', activation = 'relu')(x)
x = MaxPooling2D((2, 2), strides=(2,2))(x)
x = Conv2D(filters = 96, kernel_size = 3, padding = 'same', activation = 'relu')(x)
x = MaxPooling2D((2, 2), strides=(2,2))(x)
x = Flatten()(x)
x = Dense(512)(x)
x = Activation('relu')(x)
out = Dense(5, activation = "softmax")(x)

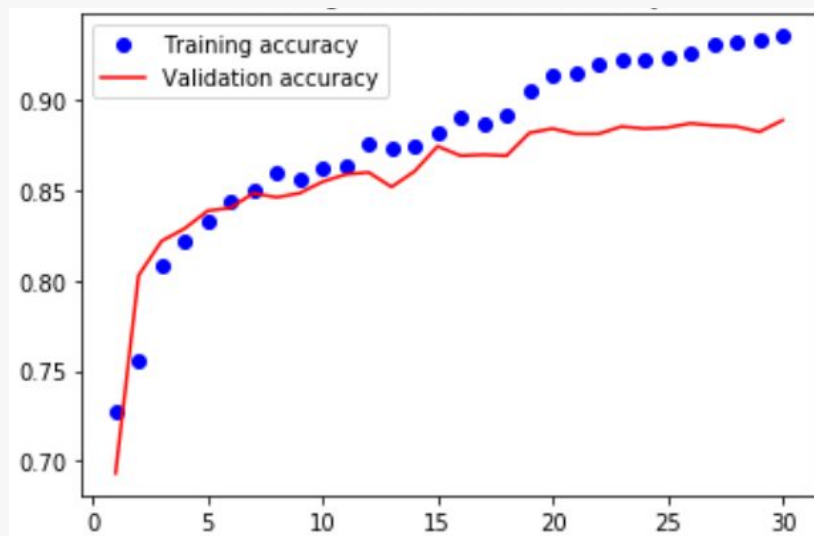
gabormodel = Model(input1, out)
gabormodel.compile(optimizer=Adam(lr=0.001), loss='binary_crossentropy', metrics=['accuracy'])
```



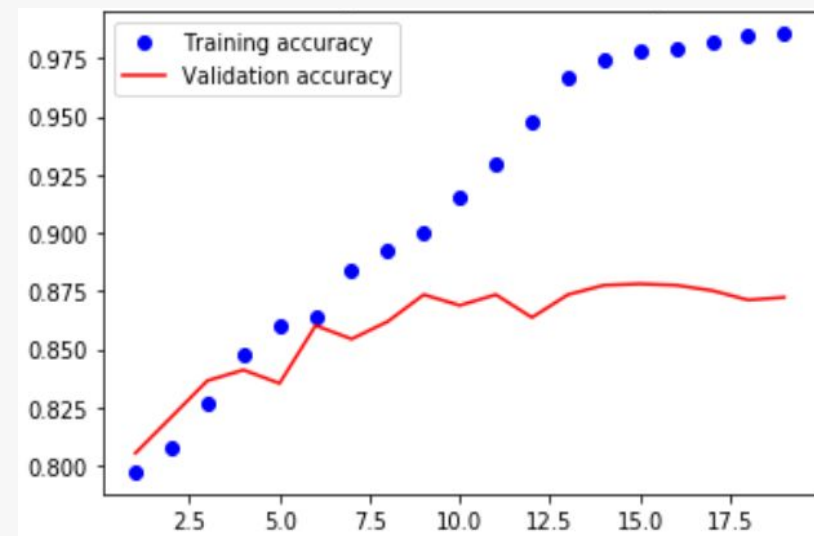
Gabor CNN



Gaussian CNN

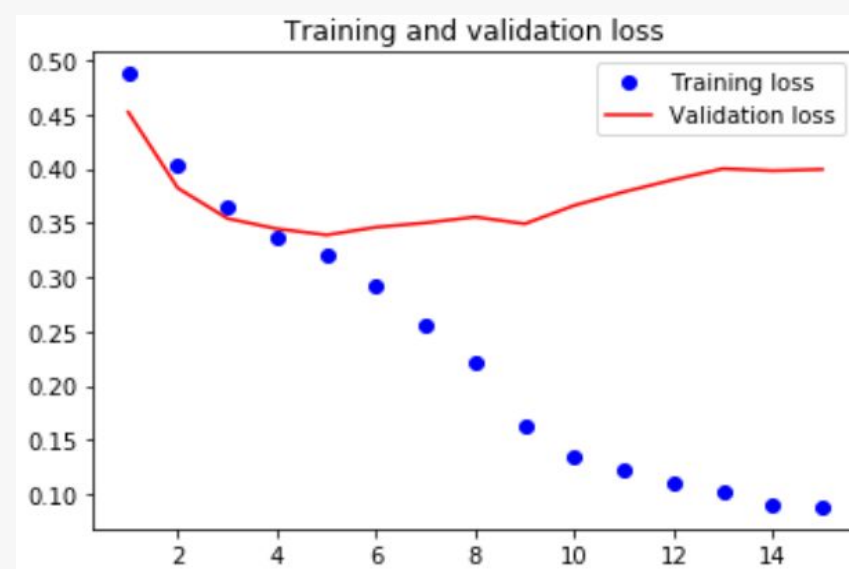


Merged CNN

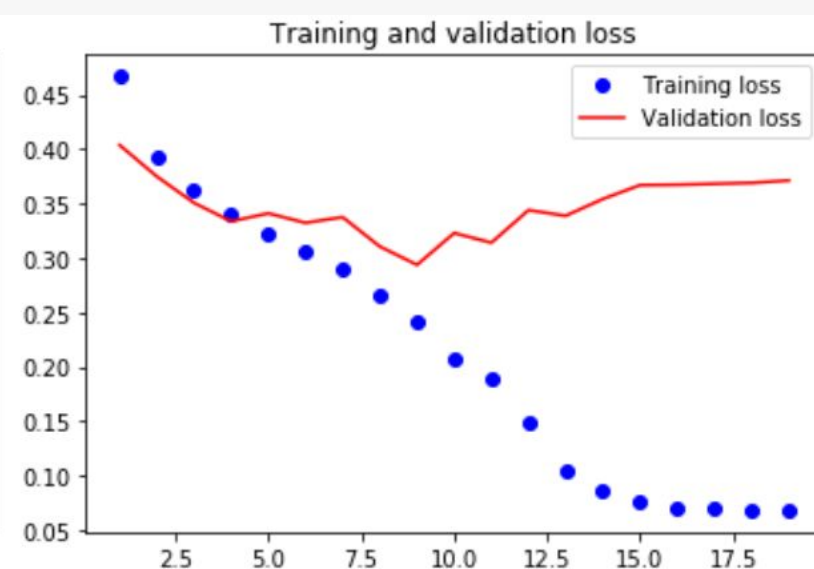


Sharpening CNN

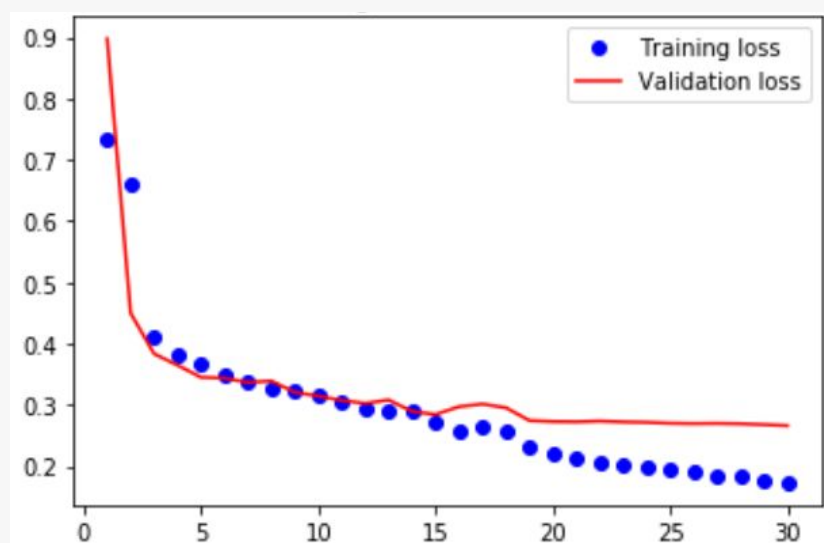
Training
and
validation
accuracy



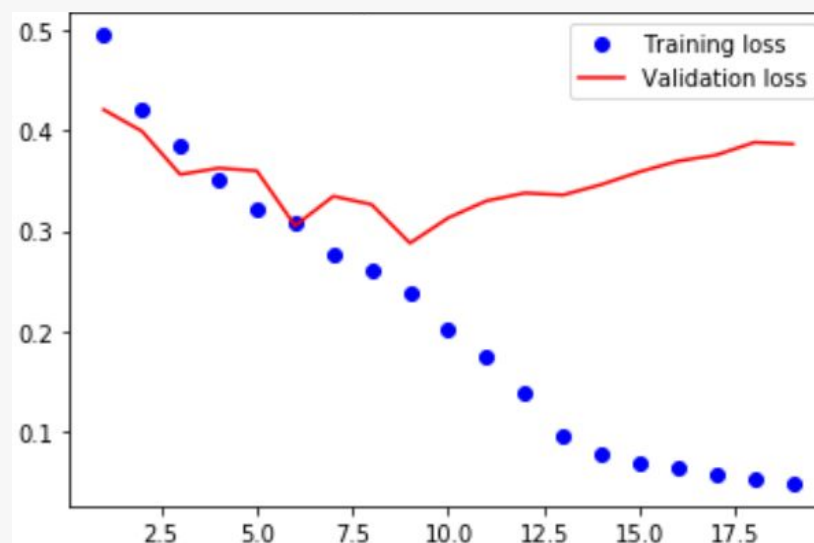
Gabor CNN



Gaussian CNN

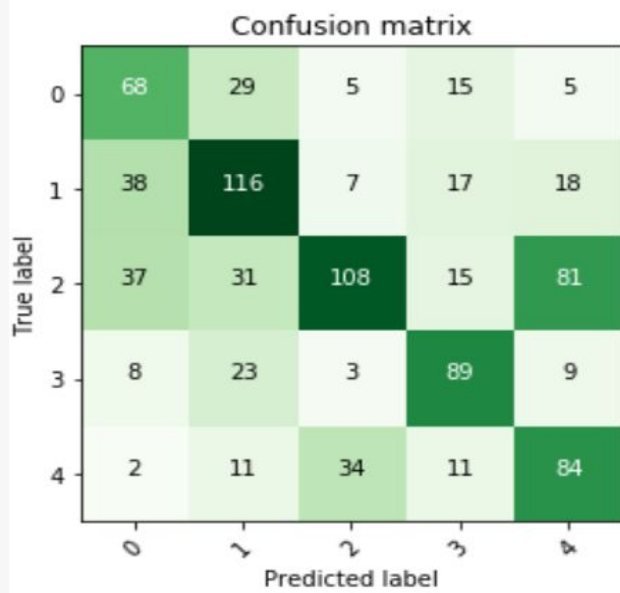


Merged CNN

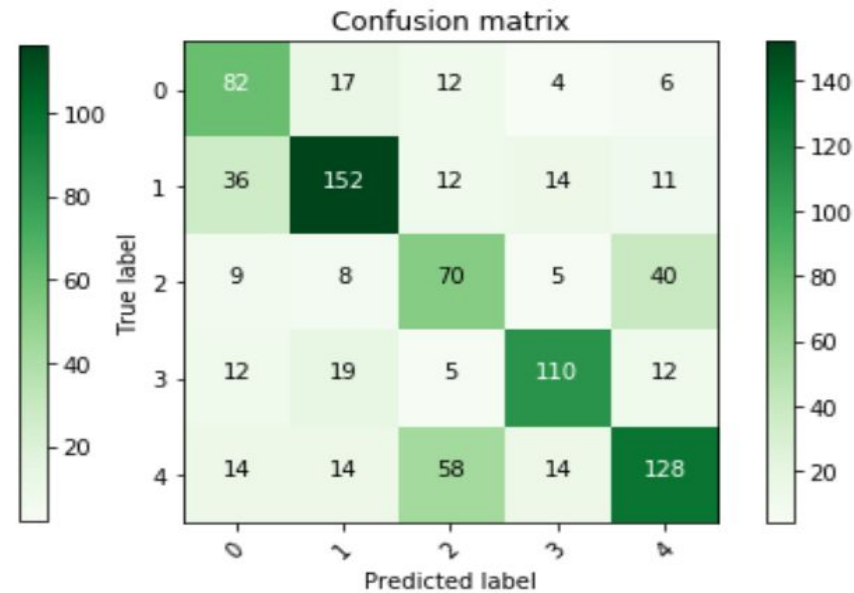


Sharpening CNN

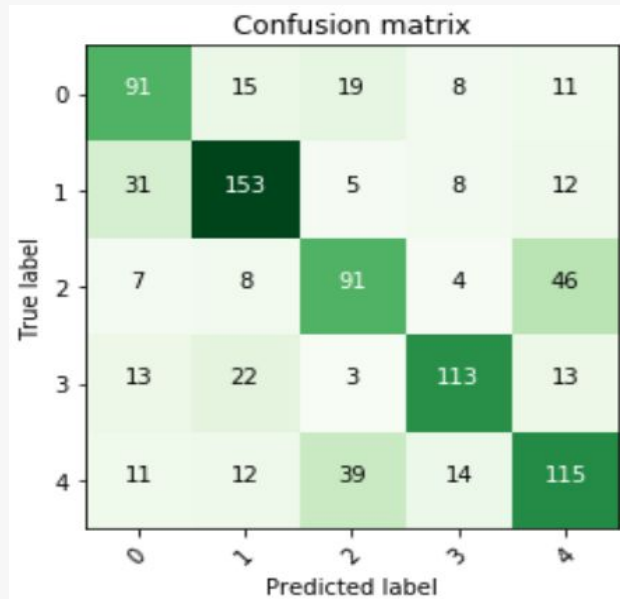
Training
and
validation
loss



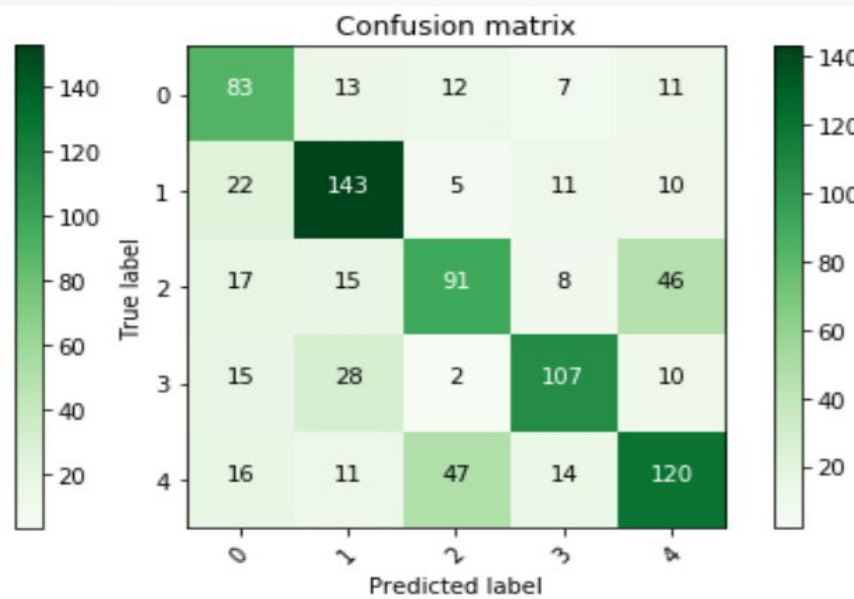
Gabor CNN



Gaussian CNN



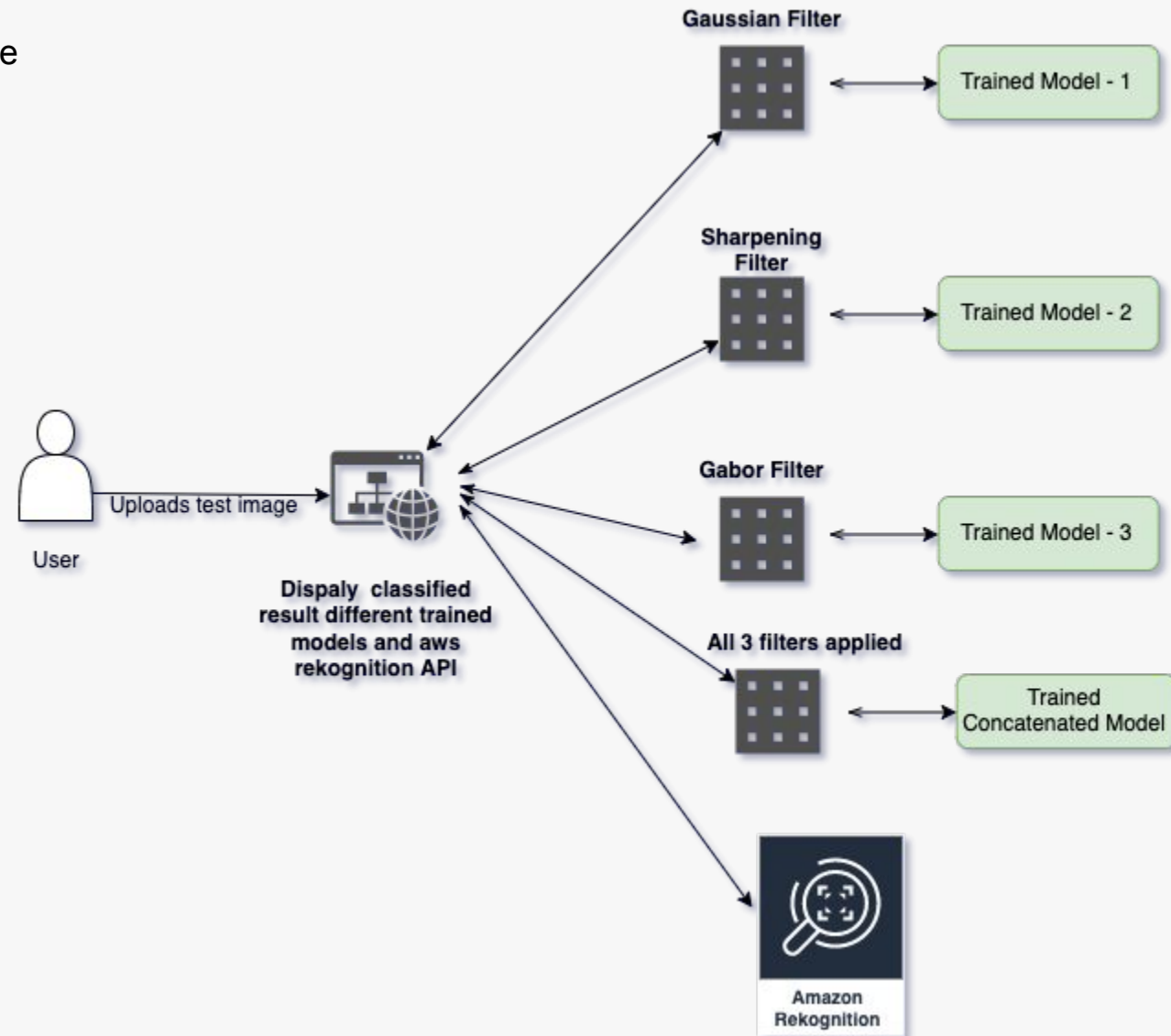
Merged CNN



Sharpening CNN

Confusion matrix

Flask Website Architecture



AWS CLI Setup and fetching credentials for Rekognition API

Users > cli

Summary

Delete user



User ARN arn:aws:iam::695112749423:user/cli

Path /

Creation time 2021-12-01 19:12 CST

Permissions

Groups

Tags

Security credentials

Access Advisor

Sign-in credentials

Summary

- User does not have console management access
- MFA is required when signing in. [Learn more](#)

Console password

Disabled | [Manage](#)

Assigned MFA device

arn:aws:iam::695112749423:mfa/cli (Virtual) | [Manage](#)

Signing certificates

None

Access keys

Last login: Thu Dec 2 20:13:18 on ttys004

aws sts get-session-token --duration-seconds 90000 --serial-number arn:aws:iam::695112749423:mfa/cli --token-code 872919

bck-i-search: get_

10313 20:15:16

```
{
  "Credentials": {
    "AccessKeyId": "ASIA2DV7S2FXT3N7N0FE",
    "SecretAccessKey": "tkMW7heeC1LRvIdu+NtaZ0ws00u/NFFTrsIiyw01",
    "SessionToken": "IQoJb3JpZ2luX2V1EQMaCXVzLWVhc3QhMSJHMEUCIA/VatdN7FYDnPT9XfgeVqus1F9j3lRk1pKVq16rSISNAiEA6xRrV/IJjGBF00VUJHNe2iD/ZCSUqrs580WKHq1Scwq7wEIOxAGgw20TUxMTI3NDk0MjMlDhd+90ki7ARnuYSZoyrMabS+r+8dekdQ06V1FTaadaEgVSLdln6o1se17Qo1o/RNqa5bpb9CZoE040PcTA1VjBC0FpAuZm+FG1Pl d8X1cl100ol3j3kiQvY82dUjTm08rMS3V5D7eu0W202PKsnNYHfP92sc9eHjwQU7nhhF1b19on0AIHl0gjx6BRCadSIEBY1LceTkNxiVj8FoH+KWrnmr06pT4v+gw7q45dbRAYjASSMNH57q07Lg3P9+aJMSylpPe4Fuy5CPY7SD1zXah6ChuvE+y9PbJmKcSTCY+6WNBjqYAbT4oJ/PykFBAITZzykEuS0chupLkYwtP3FEmJjhAHZGmtqGY5ny07sudksG3XnhvuIhbnXSSLWfrGzBKmai0NqYrxhe/S+efaTM2n6jjo9hwaj6PYy2CdoSPVe/B04Y4I5x56xgayUbo8cEnQHwGHoj2vvONLA0/yEMu0+Ec7eVFKsdnhT1WlV0oZ2DnS+wt89YBp8ohxBYZ",
    "Expiration": "2021-12-04T03:14:48+00:00"
  }
}
(END)
```


AWS Reckognition API

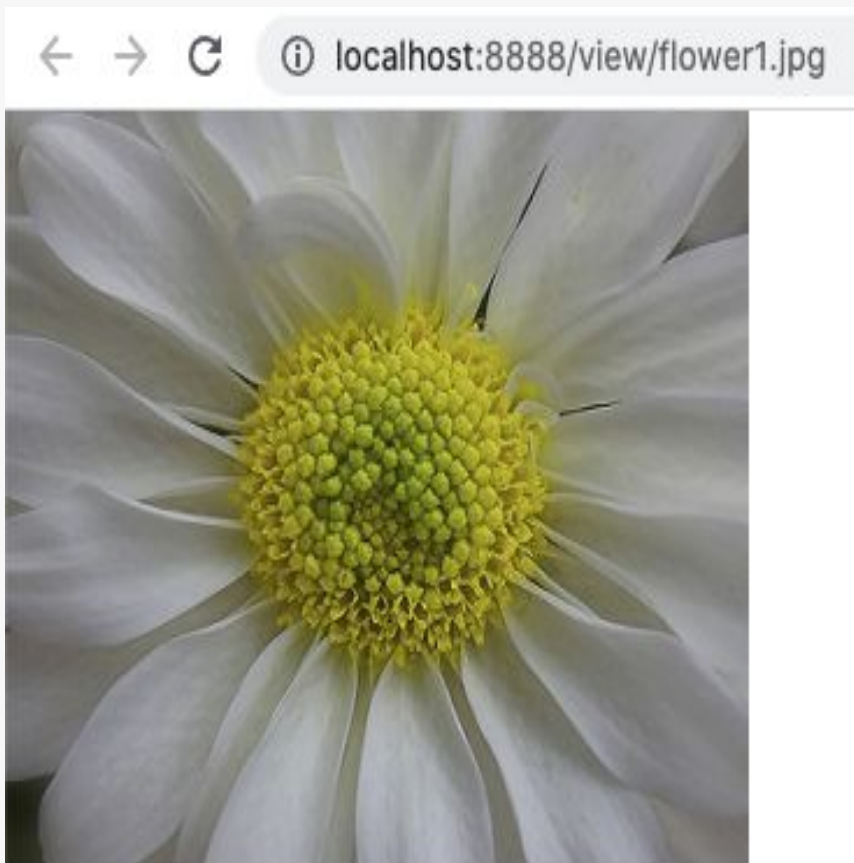


Image given as input to
the API

```
In [12]: import boto3

In [13]: # rekognition = boto3.client("rekognition", "us-east-1")

In [14]: rekognition = boto3.client(
    'rekognition',
    aws_access_key_id='ASIAVZKUOEYSO6TRIRN2',
    aws_secret_access_key='0ydsbb2Cj6wtv5K9fZ4pSnRte7BzVU3fZ0y+wF6i',
    aws_session_token='IQoJb3JpZ2luX2VjEFUaCXVzLWVhc3QtMSJGMEQCIEPrdPLWItNjFGmq2Tfbgclr9H8mHrZWwOE36JYY7uLsAiAvW5QIpsxm
)

In [15]: import os

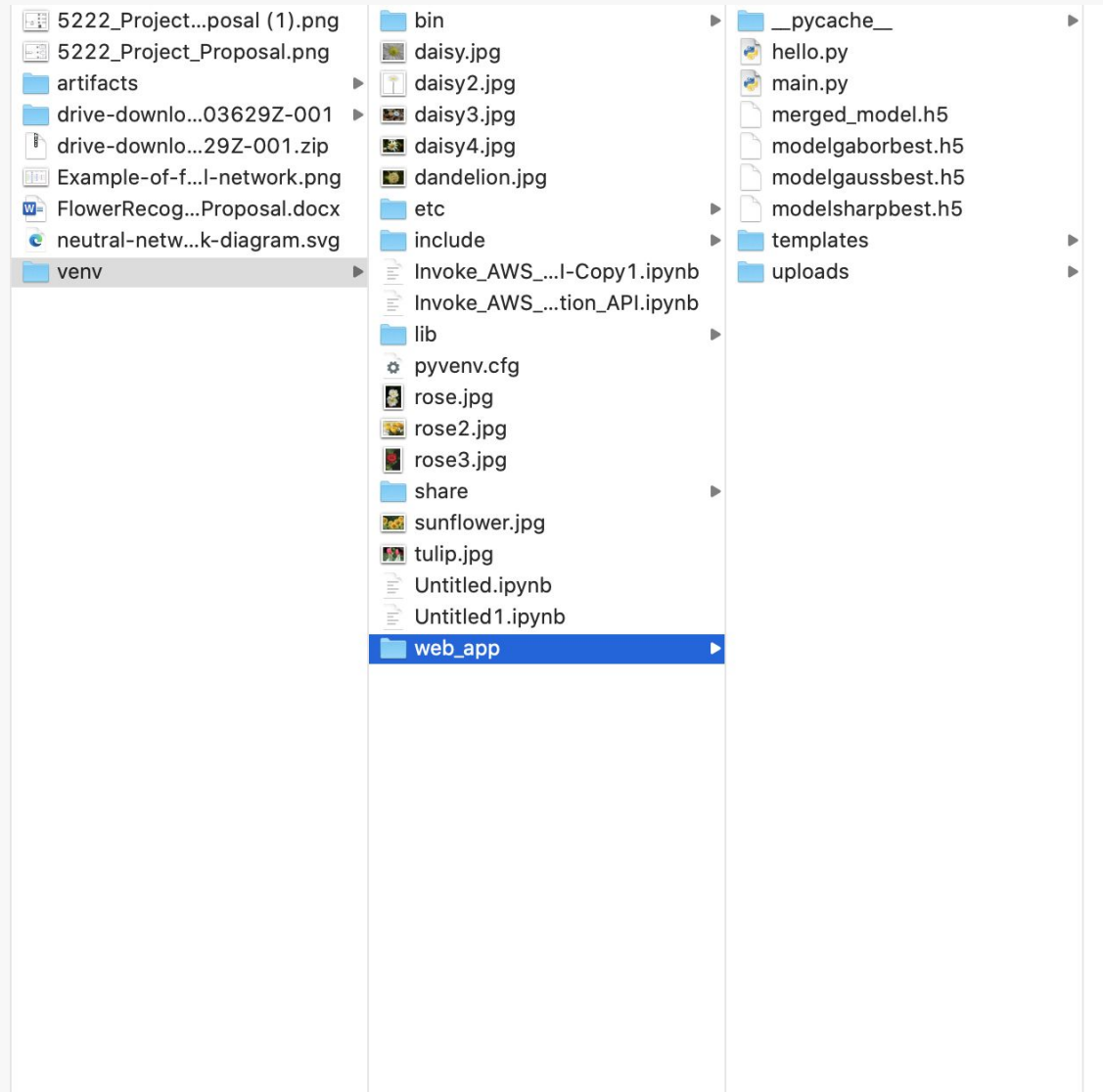
with open(os.path.join('flower1.jpg'), 'rb') as image_data:
    response_content = image_data.read()
    rekognition_response = rekognition.detect_labels(Image={'Bytes': response_content})

In [11]: rekognition_response

Out[11]: {'Labels': [{'Name': 'Plant',
    'Confidence': 99.70489501953125,
    'Instances': [{'BoundingBox': {'Width': 0.8668731451034546,
    'Height': 0.8615646958351135,
    'Left': 0.07573075592517853,
    'Top': 0.07832533866167068},
    'Confidence': 59.97138977050781}],
    'Parents': []},
    {'Name': 'Daisy',
    'Confidence': 98.83956146240234,
    'Instances': [],
    'Parents': [{'Name': 'Flower'}, {'Name': 'Plant'}]},
    {'Name': 'Daisies',
    'Confidence': 98.83956146240234,
    'Instances': [],
    'Parents': [{'Name': 'Flower'}, {'Name': 'Plant'}]},
    {'Name': 'Flower',
    'Confidence': 98.83956146240234,
    'Instances': [],
    'Parents': [{'Name': 'Plant'}]}
```

Response from Amazon Rekognition API

Flask Website Setup



Upload, classify - code in flask website

```
@app.route('/result', methods=['GET'])
def display_result():
    filename = request.args.get('filename')

    # build data frame that store result for image classification
    df_predictions = pd.DataFrame(columns=['Model', 'Predicted Flower Class', 'Probability'])

    # load uploaded image
    uploaded_image = plt.imread(os.path.join(app.config['UPLOAD_FOLDER'], filename))

    # resize image
    resize_img = cv2.resize(uploaded_image, (150,150))

    #convert to np from image
    img_as_np = np.array(resize_img)

    df_predictions, x1 = gaussian_filter_cnn_classify(df_predictions, img_as_np)
    df_predictions, x2 = gabor_filter_cnn_classify(df_predictions, img_as_np)
    df_predictions, x3 = sharpening_filter_cnn_classify(df_predictions, img_as_np)
    df_predictions = merged_model_ccn(df_predictions, [x1, x2, x3])
    df_predictions = aws_rekognition_classify(filename, df_predictions)

    return render_template('result.html', url=filename, predictions=df_predictions)

> def get_flower_name_from_class(class_number): ...

> def gaussian_filter_cnn_classify(df_predictions, img_np): ...

> def gabor_filter_cnn_classify(df_predictions, img_np): ...


> def sharpening_filter_cnn_classify(df_predictions, img_np): ...

> def merged_model_ccn(df_predictions, model_input): ...

> def aws_rekognition_classify(filename, df_predictions): ...
```

Result 1

Uploaded Image




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Model	Predicted Flower Class	Probability
Gaussian Filter CNN	Dandelion	0.9573889970779419
Gabor Filter CNN	Dandelion	0.9605498909950256
Sharpening Filter CNN	Dandelion	0.9979783892631531
Merged Model CNN	Dandelion	0.9670974612236023
Amazon Rekognition API	Dandelion	0.89904

Result 2

Uploaded Image




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Model	Predicted Flower Class	Probability
Gaussian Filter CNN	Sunflower	0.988854169845581
Gabor Filter CNN	Sunflower	0.8464449644088745
Sharpening Filter CNN	Sunflower	0.9742432832717896
Merged Model CNN	Sunflower	0.8552935719490051
Amazon Rekognition API	Sunflower	0.960577

Result 3

Uploaded Image




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Model	Predicted Flower Class	Probability
Gaussian Filter CNN	Sunflower	0.4323742985725403
Gabor Filter CNN	Daisy	0.4821966886520386
Sharpening Filter CNN	Dandelion	0.46889781951904297
Merged Model CNN	Sunflower	0.430497944355011
Amazon Rekognition API	Daisy	0.988396

Result 4

Uploaded Image



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Model	Predicted Flower Class	Probability
Gaussian Filter CNN	Tulip	0.9948581457138062
Gabor Filter CNN	Tulip	0.989429771900177
Sharpening Filter CNN	Tulip	0.99793940782547
Merged Model CNN	Tulip	0.7826806902885437
Amazon Rekognition API	Tulip	0.94513