(A)Car_views_image_dataset

1.Import Libraries

In [14]:

```
import tensorflow as tf
import os
import numpy as np
from tensorflow.keras.layers import Input,Flatten,Dense
from tensorflow.keras.models import Model
from tensorflow.keras.applications.vgg16 import VGG16
from tensorflow.keras.models import Sequential
import matplotlib.pyplot as plt
import gradio as gr
```

2.Image data generator - data preprocessing

In [15]:

```
IMAGE_SIZE=224
BATCH_SIZE=64

train_datagen=tf.keras.preprocessing.image.ImageDataGenerator(
    rescale=1./255,
    zoom_range=0.2,
    horizontal_flip=True,
    validation_split=0.1)

validation_datagen=tf.keras.preprocessing.image.ImageDataGenerator(
    rescale=1./255,
    validation_split=0.1
)
```

In [16]:

```
train="training"
train_genarator=train_datagen.flow_from_directory(
    train,
    target_size=(IMAGE_SIZE,IMAGE_SIZE),
    batch_size=BATCH_SIZE


)
test="validation"
validation_generator=validation_datagen.flow_from_directory(
    test,
    target_size=(IMAGE_SIZE,IMAGE_SIZE),
    batch_size=BATCH_SIZE


)
```

```
Found 960 images belonging to 3 classes.
Found 171 images belonging to 3 classes.
```

In [17]:

```
print("Integer values of classes:")
train_genarator.class_indices
```

```
Integer values of classes:
```

Out[17]:

```
{'front': 0, 'rear': 1, 'side': 2}
```

3.VGG16 model

In [18]:

```
IMAGE_SIZE=[224,224]
vgg=VGG16(input_shape=IMAGE_SIZE+[3],weights='imagenet',include_top=False)
vgg.output
```

Out[18]:

```
<KerasTensor: shape=(None, 7, 7, 512) dtype=float32 (created by layer 'block5_pool')>
```

In [19]:

```
for layer in vgg.layers:
    layer.trainable=False
```

In [20]:

```
x=Flatten()(vgg.output)
prediction=Dense(3,activation='softmax')(x)
model=Model(inputs=vgg.input,outputs=prediction)
model.summary()
```

```
Model: "model_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 input_2 (InputLayer)        [(None, 224, 224, 3)]     0         
                                                                 
 block1_conv1 (Conv2D)       (None, 224, 224, 64)      1792      
                                                                 
 block1_conv2 (Conv2D)       (None, 224, 224, 64)      36928     
                                                                 
 block1_pool (MaxPooling2D)  (None, 112, 112, 64)      0         
                                                                 
 block2_conv1 (Conv2D)       (None, 112, 112, 128)     73856     
                                                                 
 block2_conv2 (Conv2D)       (None, 112, 112, 128)     147584    
                                                                 
 block2_pool (MaxPooling2D)  (None, 56, 56, 128)       0         
                                                                 
 block3_conv1 (Conv2D)       (None, 56, 56, 256)       295168    
                                                                 
 block3_conv2 (Conv2D)       (None, 56, 56, 256)       590080    
                                                                 
 block3_conv3 (Conv2D)       (None, 56, 56, 256)       590080    
                                                                 
 block3_pool (MaxPooling2D)  (None, 28, 28, 256)       0         
                                                                 
 block4_conv1 (Conv2D)       (None, 28, 28, 512)       1180160   
                                                                 
 block4_conv2 (Conv2D)       (None, 28, 28, 512)       2359808   
                                                                 
 block4_conv3 (Conv2D)       (None, 28, 28, 512)       2359808   
                                                                 
 block4_pool (MaxPooling2D)  (None, 14, 14, 512)       0         
                                                                 
 block5_conv1 (Conv2D)       (None, 14, 14, 512)       2359808   
                                                                 
 block5_conv2 (Conv2D)       (None, 14, 14, 512)       2359808   
                                                                 
 block5_conv3 (Conv2D)       (None, 14, 14, 512)       2359808   
                                                                 
 block5_pool (MaxPooling2D)  (None, 7, 7, 512)         0         
                                                                 
 flatten_1 (Flatten)         (None, 25088)             0         
                                                                 
 dense_1 (Dense)             (None, 3)                 75267     
                                                                 
=================================================================
Total params: 14,789,955
Trainable params: 75,267
Non-trainable params: 14,714,688
_________________________________________________________________
```

4.Train the model

In [21]:

```
model.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
```

In [10]:

```
model.save("train1.h5")
fn11='log3.csv'
history_logger=tf.keras.callbacks.CSVLogger(fn11,separator=",",append=True)
```

In [91]:

```
epoch=10

history=model.fit(train_genarator,
                  steps_per_epoch=len(train_genarator),
                  epochs=epoch,
                  callbacks=[history_logger],
                  validation_data=validation_generator,
                  validation_steps=len(validation_generator)
                 )
```

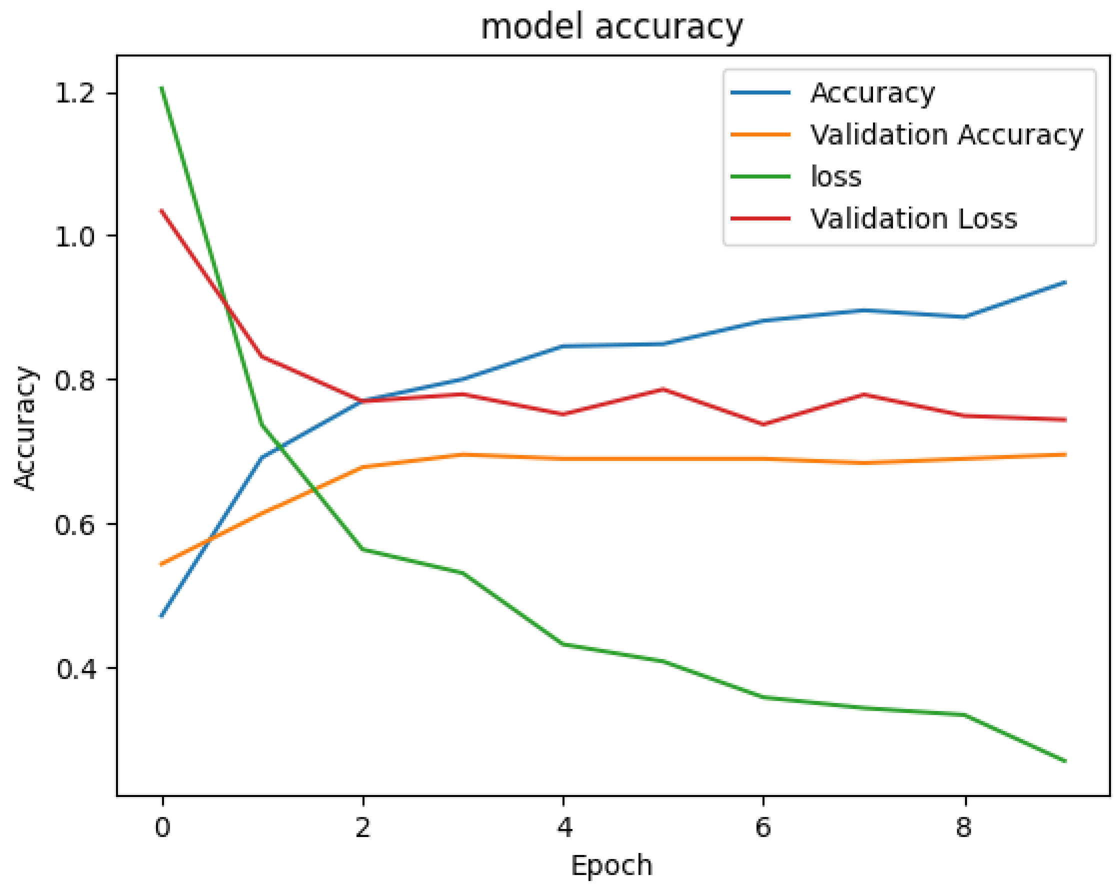
```
Epoch 1/10
15/15 [==============================] - 207s 14s/step - loss: 1.2044 - accuracy: 0.4719 - val_loss: 1.0337 - val_accuracy: 0.5439
Epoch 2/10
15/15 [==============================] - 209s 14s/step - loss: 0.7366 - accuracy: 0.6917 - val_loss: 0.8314 - val_accuracy: 0.6140
Epoch 3/10
15/15 [==============================] - 213s 14s/step - loss: 0.5640 - accuracy: 0.7698 - val_loss: 0.7691 - val_accuracy: 0.6784
Epoch 4/10
15/15 [==============================] - 215s 14s/step - loss: 0.5311 - accuracy: 0.8000 - val_loss: 0.7791 - val_accuracy: 0.6959
Epoch 5/10
15/15 [==============================] - 219s 15s/step - loss: 0.4321 - accuracy: 0.8458 - val_loss: 0.7512 - val_accuracy: 0.6901
Epoch 6/10
15/15 [==============================] - 223s 15s/step - loss: 0.4082 - accuracy: 0.8490 - val_loss: 0.7859 - val_accuracy: 0.6901
Epoch 7/10
15/15 [==============================] - 224s 15s/step - loss: 0.3584 - accuracy: 0.8813 - val_loss: 0.7372 - val_accuracy: 0.6901
Epoch 8/10
15/15 [==============================] - 235s 16s/step - loss: 0.3434 - accuracy: 0.8958 - val_loss: 0.7786 - val_accuracy: 0.6842
Epoch 9/10
15/15 [==============================] - 230s 15s/step - loss: 0.3339 - accuracy: 0.8865 - val_loss: 0.7491 - val_accuracy: 0.6901
Epoch 10/10
15/15 [==============================] - 234s 16s/step - loss: 0.2700 - accuracy: 0.9344 - val_loss: 0.7437 - val_accuracy: 0.6959
```

In [ ]:

Model accuracy

In [92]:

```
plt.plot(history.history["accuracy"])
plt.plot(history.history['val_accuracy'])
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title("model accuracy")
plt.ylabel("Accuracy")
plt.xlabel("Epoch")
plt.legend(["Accuracy","Validation Accuracy","loss","Validation Loss"])
plt.show()
```



5.Test the model

Test_Image1

In [120]:

```
from tensorflow.keras.utils import load_img
from tensorflow.keras.utils import img_to_array
import numpy as np
from tensorflow import keras
model1=keras.models.load_model("train1.h5")
img_pred=load_img("test/frontside.jpg",target_size=(224,224))
plt.imshow(img_pred, cmap=plt.get_cmap('gray'))

img_pred=img_to_array(img_pred)

img_pred=np.expand_dims(img_pred, axis=0)

rslt= model1.predict(img_pred)

print(rslt)
print()
if rslt[0][0]>rslt[0][1]:
    if rslt[0][2]>rslt[0][0]:
        prediction="side image"
    else:
        prediction="front image"

else:
    prediction="rear image"
print("VIEW OF THE CAR IMAGE:")
print(prediction)
```

```
1/1 [==============================] - 0s 251ms/step
[[1.0000000e+00 3.6214376e-26 1.2078510e-30]]

VIEW OF THE CAR IMAGE:
front image
```

(B)Damage_level_Image_dataset

1.Preprocessing

In [22]:

```
IMAGE_SIZE_damage=224
BATCH_SIZE_damage=32
train_datagen_damage=tf.keras.preprocessing.image.ImageDataGenerator(
    rescale=1./255,
    zoom_range=0.2,
    horizontal_flip=True,
    validation_split=0.1)

validation_datagen_damage=tf.keras.preprocessing.image.ImageDataGenerator(
    rescale=1./255,
    validation_split=0.1
)
```

In [23]:

```
train_damage="training_damage"
train_generator_damage=train_datagen_damage.flow_from_directory(
    train_damage,
    target_size=(IMAGE_SIZE_damage,IMAGE_SIZE_damage),
    batch_size=BATCH_SIZE_damage


)
test_damage="validation_damage"
validation_generator_damage=validation_datagen_damage.flow_from_directory(
    test_damage,
    target_size=(IMAGE_SIZE_damage,IMAGE_SIZE_damage),
    batch_size=BATCH_SIZE_damage
)
```

```
Found 571 images belonging to 3 classes.
Found 35 images belonging to 3 classes.
```

In [24]:

```
print("Integer values of classes:")
train_generator_damage.class_indices
```

```
Integer values of classes:
```

Out[24]:

```
{'high': 0, 'low': 1, 'severe': 2}
```

2.VGG16 model

In [25]:

```
IMAGE_SIZE_damage=[224,224]
vgg_damage=VGG16(input_shape=IMAGE_SIZE_damage+[3],weights='imagenet',include_top=False)
vgg_damage.output
```

Out[25]:

```
<KerasTensor: shape=(None, 7, 7, 512) dtype=float32 (created by layer 'block5_pool')>
```

In [26]:

```
for layer_d in vgg_damage.layers:
    layer_d.trainable=False
```

In [27]:

```
x_d=Flatten()(vgg_damage.output)
prediction_damage=Dense(3,activation='softmax')(x_d)
model_damage=Model(inputs=vgg_damage.input,outputs=prediction_damage)
model_damage.summary()
```

```
Model: "model_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 input_3 (InputLayer)        [(None, 224, 224, 3)]     0         
                                                                 
 block1_conv1 (Conv2D)       (None, 224, 224, 64)      1792      
                                                                 
 block1_conv2 (Conv2D)       (None, 224, 224, 64)      36928     
                                                                 
 block1_pool (MaxPooling2D)  (None, 112, 112, 64)      0         
                                                                 
 block2_conv1 (Conv2D)       (None, 112, 112, 128)     73856     
                                                                 
 block2_conv2 (Conv2D)       (None, 112, 112, 128)     147584    
                                                                 
 block2_pool (MaxPooling2D)  (None, 56, 56, 128)       0         
                                                                 
 block3_conv1 (Conv2D)       (None, 56, 56, 256)       295168    
                                                                 
 block3_conv2 (Conv2D)       (None, 56, 56, 256)       590080    
                                                                 
 block3_conv3 (Conv2D)       (None, 56, 56, 256)       590080    
                                                                 
 block3_pool (MaxPooling2D)  (None, 28, 28, 256)       0         
                                                                 
 block4_conv1 (Conv2D)       (None, 28, 28, 512)       1180160   
                                                                 
 block4_conv2 (Conv2D)       (None, 28, 28, 512)       2359808   
                                                                 
 block4_conv3 (Conv2D)       (None, 28, 28, 512)       2359808   
                                                                 
 block4_pool (MaxPooling2D)  (None, 14, 14, 512)       0         
                                                                 
 block5_conv1 (Conv2D)       (None, 14, 14, 512)       2359808   
                                                                 
 block5_conv2 (Conv2D)       (None, 14, 14, 512)       2359808   
                                                                 
 block5_conv3 (Conv2D)       (None, 14, 14, 512)       2359808   
                                                                 
 block5_pool (MaxPooling2D)  (None, 7, 7, 512)         0         
                                                                 
 flatten_2 (Flatten)         (None, 25088)             0         
                                                                 
 dense_2 (Dense)             (None, 3)                 75267     
                                                                 
=================================================================
Total params: 14,789,955
Trainable params: 75,267
Non-trainable params: 14,714,688
_________________________________________________________________
```

In [28]:

```
model_damage.compile(loss='categorical_crossentropy', optimizer='adam', metrics=['accuracy'])
```

In [19]:

```
model_damage.save("train2.h5")
fn12='log1.csv'
logger=tf.keras.callbacks.CSVLogger(fn12,separator=",",append=True)
```

3.Train the model

In [77]:

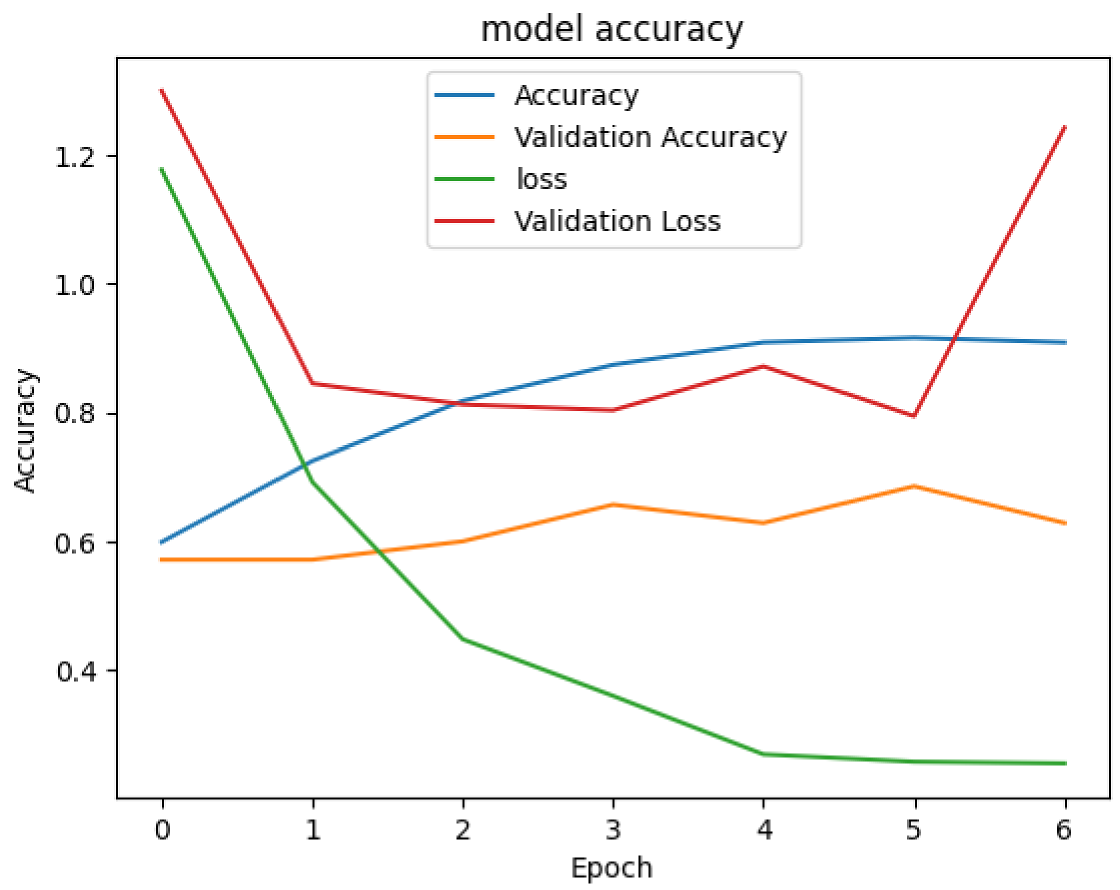
```
epoch_d=7
history_damage=model_damage.fit(train_generator_damage,
                  steps_per_epoch=len(train_generator_damage),
                  epochs=epoch_d,
                  callbacks=[logger],
                  validation_data=validation_generator_damage,
                  validation_steps=len(validation_generator_damage)
                 )
```

```
Epoch 1/7
18/18 [==============================] - 107s 6s/step - loss: 1.1776 - accuracy: 0.5989 - val_loss: 1.3002 - val_accuracy: 0.5714
Epoch 2/7
18/18 [==============================] - 114s 6s/step - loss: 0.6921 - accuracy: 0.7250 - val_loss: 0.8449 - val_accuracy: 0.5714
Epoch 3/7
18/18 [==============================] - 111s 6s/step - loss: 0.4477 - accuracy: 0.8179 - val_loss: 0.8123 - val_accuracy: 0.6000
Epoch 4/7
18/18 [==============================] - 115s 6s/step - loss: 0.3596 - accuracy: 0.8739 - val_loss: 0.8032 - val_accuracy: 0.6571
Epoch 5/7
18/18 [==============================] - 116s 6s/step - loss: 0.2686 - accuracy: 0.9089 - val_loss: 0.8715 - val_accuracy: 0.6286
Epoch 6/7
18/18 [==============================] - 118s 7s/step - loss: 0.2571 - accuracy: 0.9159 - val_loss: 0.7941 - val_accuracy: 0.6857
Epoch 7/7
18/18 [==============================] - 119s 7s/step - loss: 0.2546 - accuracy: 0.9089 - val_loss: 1.2429 - val_accuracy: 0.6286
```

Model accuracy

In [78]:

```
plt.plot(history_damage.history["accuracy"])
plt.plot(history_damage.history['val_accuracy'])
plt.plot(history_damage.history['loss'])
plt.plot(history_damage.history['val_loss'])
plt.title("model accuracy")
plt.ylabel("Accuracy")
plt.xlabel("Epoch")
plt.legend(["Accuracy","Validation Accuracy","loss","Validation Loss"])
plt.show()
```



4.Test the model

Test a damage level

In [136]:

```
from tensorflow.keras.utils import array_to_img
from tensorflow.keras.utils import load_img
from tensorflow.keras.utils import img_to_array
from tensorflow import keras
from tensorflow import keras
model2=keras.models.load_model("train2.h5")
import numpy as np
img_pred_1=load_img("test/damage2.jpg",target_size=(224,224))
plt.imshow(img_pred_1, cmap=plt.get_cmap('gray'))

img_pred_1=img_to_array(img_pred_1)
img_pred_1=np.expand_dims(img_pred_1, axis=0)

print()
rst=model2.predict(img_pred_1)

if rst[0][0]>rst[0][1]:
    if rst[0][2]>rst[0][0]:
        predicts="low damage"
    else:
        predicts="mild damage"

else:
    predicts="severe damage"

print(rst)
print()
print("DAMAGE LEVEL:")
print()
print(predicts)
```

```
1/1 [==============================] - 0s 248ms/step
[[5.038547e-16 9.999651e-01 3.495875e-05]]

DAMAGE LEVEL:

severe damage
```

(C) Premium amount calculation

Sub function definition

In [29]:

```
#class_view{0:front,1:rear,2:side}
#class_damage(0:low,1:mild,2:high)

#function---depreciation and IDV
def calcidv(r,v,d):
    if(d==0):
        if(v==0):
            d_dep=0.5*r
            return d_dep
        elif(v==1):
            d_dep=0.07*r
            return d_dep
        else:
            d_dep=0.06*r
            return d_dep
    elif(d==1):
        if(v==0):
            d_dep=0.12*r
            return d_dep
        elif(v==0):
            d_dep=0.14*r
            return d_dep
        else:
            d_dep=0.15*r
            return d_dep
    elif(d==2):
        if(v==0):
            d_dep=0.17*r
            return d_dep
        elif(v==1):
            d_dep=0.18*r
            return d_dep
        else:
            d_dep=0.20*r
            return d_dep



#funtion------price
def calculate(c,m,e,f):
    if(model=="tata" and m=="tiago"):
        price=649000
        return price
    else:
        if(f=="cng"):
            price=296661
            return price
        else:
            price=292667
            return price
    if(c=="renault" and m=="triber"):
        price=559000
        return price
    else:
        if(e==999):
            price=470990
            return price
        else:
            price=413290
            return price
    if(c=="dutsan" and m=="go"):
        price=528464
        return price
    else:
        if(e==999):
            price=43765
            return price
        else:
            price=351832
            return price
    if(c=="hyndai" and f=="cng"):
        price=547990
        return price
    else:
        price=503990
        return price
    return

#function-----premium amount calculator
def calculator(i):
    print("TOTAL PREMIUM AMOUNT:")
    own_damage=0.01970*i
    ncb_discount=0.2*own_damage
    od_premium=own_damage-ncb_discount
    net_premium=od_premium+100+50+1110
    gst=0.16*net_premium
    premium=gst+net_premium
    print("premium amount",premium)
    return premium
```

Views and damage level prediction

In [30]:

```
from tensorflow.keras.utils import array_to_img

from tensorflow.keras.utils import img_to_array
from tensorflow import keras
model3=keras.models.load_model("train1.h5")
from tensorflow import keras
model4=keras.models.load_model("train2.h5")


def image_pred(i):
    i=img_to_array(i)
    i=np.expand_dims(i, axis=0)

    #________________views prediction________________

    result1= model3.predict(i)

    if result1[0][0]>result1[0][1]:
        if result1[0][2]>result1[0][0]:
            prediction="side image"
            class_views=2
        else:
            prediction="front image"
            class_views=0
    else:
        prediction="rear image"
        class_views=1

    #__________________damage prediction______________________
    result2=model4.predict(i)

    if result2[0][0]>result2[0][1]:
        if result2[0][2]>result2[0][0]:
            predict="severe damage"
            class_damage=2
        else:
            predict="mild damage"
            class_damage=1

    else:
        predict="low damage"
        class_damage=0

    return class_views,class_damage,prediction,predict
```

Premium Prediction - main function

In [31]:

```python

#----------mainfunction---------

#---------variables------------

def premium_prediction(name,contact_number,car_image,company_name,car_model,engine_capacity,fuel_type):
    n=name
    m=contact_number
    img=car_image
    cmp_name=company_name
    model=car_model
    engine=engine_capacity
    fuel=fuel_type
    #---------variables------------
    models=["tiago","nano_genx","triber","kwid","go","redi_go","santro"]
    dictc={"tata":("tiago","nano genx"),"renault":("triber","kwid"),"datsun":("go","redi_go"),"hyndai":("santro")}
    dengine={"tiago":("1199"),"nano":("624"), "kwid": ("999","799"), "triber":("999"), "go":("1198"),"redi":("999","799"),"santro":("1086")}
    #fuel type
    cng={"nano_genx","santro",""}
    class_views,class_damage,a,b=image_pred(img)
    verify=1
    if len(m)<10:
        verify=0
        msg="error!!!---contact number should be in 10 digit"
        return msg
    for i in m:
        if not(i>='0' and i<='9'):
            verify=0
            msg="error!!---enter valid contact number"
            return msg


    #-----------verfication--entered company and other details were real-----------------
    #---------function calling----------------------
    if cmp_name in dictc.keys():
        l=list(dictc[cmp_name])
        verify+=1
        if model in l:
            if(dengine[model]=="kwid"):
                l_eng=list(dengine[model])
            else:
                l_eng=str(dengine[model])
            verify+=1
            if engine in l_eng:
                verify+=1
                if fuel_type=="cng":
                    if model in cng:
                        verify+=1
                        rate=str(calculate(cmp_name,model,engine,fuel_type))
                        loss=calcidv(rate,class_views,class_damage)
                        idv=rate-loss
                        premium=calculator(idv)

                else:
                    verify+=1
                    print("")
                    rate=calculate(cmp_name,model,engine,fuel_type)
                    loss=calcidv(rate,class_views,class_damage)
                    idv=rate-loss
                    premium=calculator(idv)
            else:
                msg="entered engine capacity not belongs to the car model--"+model+"\n__enter valid details"
        else:
            msg="entered car model not belongs to the company--"+cmp_name+"\n\nmodel available in this website---"+str(dictc[cmp_name])+"\n__enter valid details"
    else:
        msg="sorry!! <<<your car comany detail is not available>>>"

    if(verify==5):
        msg="VERIFIED"
        return ("customer name:  "+n+"\n"+"contact:  "+m+"\n"+msg+"...."+"\n\n----------------------------------------------------------------\n"
                +"\n"+"View of the car:  "+a+"\n "+"Damage level of the car:  "+b+"\n\n"+
                "Original price:  "+str(rate)+" \n"+"Depreciation rate:  "+str(loss)+"\n"+"IDV amount:  "+
                str(idv)+"\n"+"Premium amount:  "+str(premium))
    else:
        return(msg)
from tensorflow.keras.utils import load_img
```

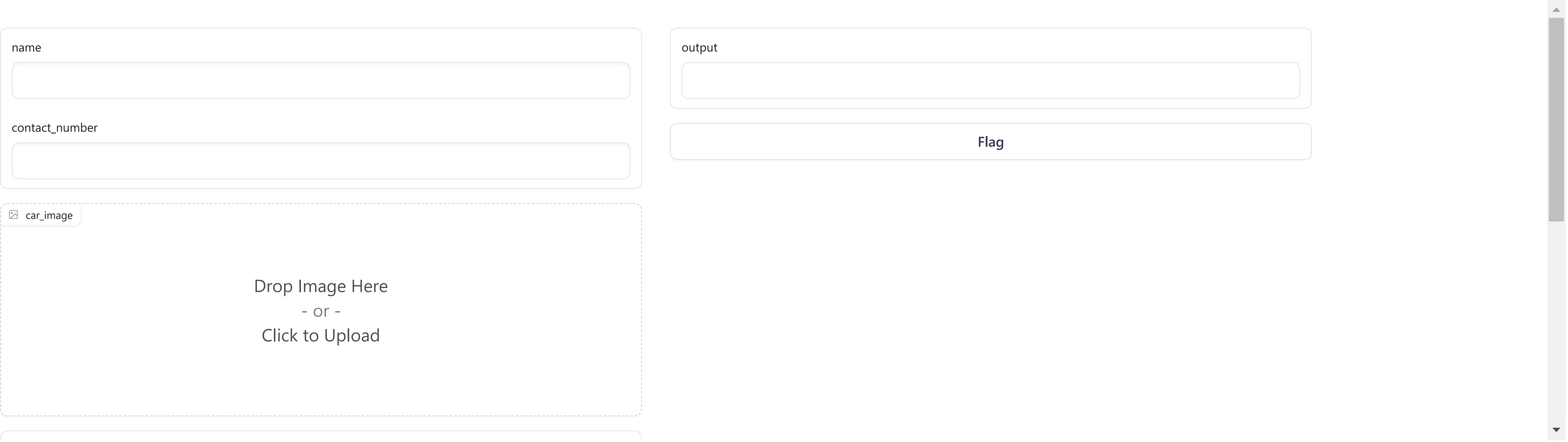
(D)User interface using gradio

```
In [33]: image=gr.inputs.Image(shape=(224,224))
         interface=gr.Interface(fn=premium_prediction,inputs=["text","text",image,"text","text","text","text"],outputs=['text']).launch()
```

```
c:\newpython\lib\site-packages\gradio\inputs.py:256: UserWarning: Usage of gradio.inputs is deprecated, and will not be supported in the future, please import your component from gradio.components
  warnings.warn(
c:\newpython\lib\site-packages\gradio\deprecation.py:40: UserWarning: `optional` parameter is deprecated, and it has no effect
  warnings.warn(value)

Running on local URL:  http://127.0.0.1:7861 (http://127.0.0.1:7861)

To create a public link, set `share=True` in `launch()`.
```



```
In [ ]:
```

```
In [ ]:
```