[6]: t[6]:	<pre>from IPython.display import clear_output from sklearn.model_selection import train_test_split from imblearn.under_sampling import RandomUnderSampler from tqdm import tqdm from sklearn.metrics import confusion_matrix,ConfusionMatrixDisplay, accuracy_score,fl_score, classification Loading and Analysis of Data df= pd.read_csv('skin_lesions.csv') df</pre>
	0ISIC_0025030Benign keratosis-like lesions1.0scalp1ISIC_0025661Benign keratosis-like lesions1.0scalp2ISIC_0027850Benign keratosis-like lesions1.0ear3ISIC_0025837Benign keratosis-like lesions1.0back4ISIC_0025209Benign keratosis-like lesions1.0back5365ISIC_0030965Melanocytic nevi1.0NaN
[8]:	5366 ISIC_0028490 Benign keratosis-like lesions 1.0 NaN 5367 ISIC_0026722 Melanoma 1.0 NaN 5368 ISIC_0029038 Melanocytic nevi 1.0 NaN 5369 ISIC_0032603 Benign keratosis-like lesions 1.0 NaN 5370 rows × 4 columns # check for the missing values in the csv df.isna().sum() image id 0
[9]: [10]:	<pre>cell_type 100 is_benign 100 localization 13 dtype: int64 # drop the rows with missing values df = df.dropna() # again check for missing values df.isna().sum() image_id 0 cell_type 0</pre>
[11]: [11]:	localization 0 dtype: int64
	4000 - 3500 - 2500 - 2000 - 1500 - 500 - 0
[12]:	Observations • The dataset is imbalanced. X=df.drop('is_benign', axis=1) y= df['is_benign'] # down saple the dataset to balance the data rus = RandomUnderSampler() X_un, y_un = rus.fit_resample(X, y)
	<pre>print("Before UnderSampling, counts of label '1': {}".format(sum(y_un == 1))) print("Before UnderSampling, counts of label '0': {} \n".format(sum(y_un == 0))) print("After UnderSampling, counts of label '1': {}".format(sum(y_un == 1))) print("After UnderSampling, counts of label '0': {} \n".format(sum(y_un == 0))) print("After UnderSampling, the shape of train_X: {}".format(X_un.shape)) print("After UnderSampling, the shape of train_y: {} \n".format(y_un.shape)) Before UnderSampling, counts of label '1': 1013 Before UnderSampling, counts of label '1': 1013 After UnderSampling, counts of label '1': 1013 After UnderSampling, counts of label '0': 1013</pre>
[9]: t[9]:	After UnderSampling, the shape of train_X: (2026, 3) After UnderSampling, the shape of train_y: (2026,) #check the class distribution again print(y_un.value_counts()) y_un.value_counts().plot.bar() 1.0 1013 0.0 1013 Name: is_benign, dtype: int64 <axessubplot:></axessubplot:>
	1000 - 800 - 600 - 400 - 200 -
[13]:	<pre># There is no missing values # now lets load the images all_data=[] labels=[] for i in tqdm (range(len(X_un))): path="/Users/priyank_7/Documents/Jupiter/Skinlesions/skin_lesions_images/"+X_un["image_id"][i]+".jpg" #print(path) img=cv2.imread(path) img=cv2.resize(img,(150,150))</pre>
[11]: [12]:	<pre>img=cv2.cvtColor(img, cv2.COLOR_BGR2RGB) img=img*(1/255) all_data.append(img) labels.append(y_un[i]) 100%[</pre>
[13]:	<pre>print("Shape of labels = ",labels.shape) Max pixel value = 1.0 Shape of images = (2026, 150, 150, 3) Shape of labels = (2026,)</pre>
	<pre>ax.imshow(img) ax.axis('off') title="Class Label ="+str(labels[i]) ax.set_title(title) i+=1 plt.tight_layout() plt.show() plot_images(all_data[:10],labels[:10])</pre> Class Label = 0.0 Class Label = 0.0 Class Label = 0.0 Class Label = 0.0 Class Label = 0.0
	Class Label =0.0 Class Label =0.0 Class Label =0.0 Class Label =0.0
[14]:	<pre># Train and valid split X_train, X_test, y_train, y_test = train_test_split(all_data, labels, test_size=0.3, random_state=42) del(all_data) del(labels) print("Shape of training images = ",X_train.shape) print("Shape of training labels = ",y_train.shape) print("Shape of validation images = ",X_test.shape) print("Shape of validation labels = ",y_test.shape) Shape of training images = (1418, 150, 150, 3) Shape of training labels = (1418,)</pre>
[14]:	<pre>Shape of validation images = (608, 150, 150, 3) Shape of validation labels = (608,) # plot accuracy, loss curve (graph) class PlotLearning(keras.callbacks.Callback): def on_train_begin(self, logs={}): self.i = 0 self.x = [] self.losses = [] self.val_losses = [] self.val_acc = [] self.val_acc = [] self.fig = plt.figure()</pre>
	<pre>self.logs = [] def on_epoch_end(self, epoch, logs={}): self.logs.append(logs) self.x.append(self.i) self.losses.append(logs.get('loss')) self.val_losses.append(logs.get('val_loss')) self.acc.append(logs.get('accuracy')) self.val_acc.append(logs.get('val_accuracy')) self.i += 1</pre>
	<pre>f, (ax1, ax2) = plt.subplots(1, 2, sharex=True) clear_output(wait=True) ax1.set_yscale('log') ax1.plot(self.x, self.losses, label="loss") ax1.plot(self.x, self.val_losses, label="val_loss") ax1.plot(self.x, self.val_losses, label="val_loss") ax1.legend() ax2.plot(self.x, self.acc, label="accuracy") ax2.plot(self.x, self.val_acc, label="validation accuracy") ax2.legend()</pre>
[15]:	<pre>plt.show(); accuracy_loss_plot = PlotLearning() Model # import a pretrained VGG16 model for transfer learning # creating sequential model vgg = VGG16 (include_top=False, weights='imagenet', input_shape=(150,150,3))</pre>
	<pre>vgg.summary() #transfer_layer = vgg.get_layer('block5_pool') # Freeze the layer for layer in vgg.layers: layer.trainable = False #Flatten the output from the 3rd block of the VGG16 model x = Flatten() (vgg.output) # = Dense(256, activation='relu')(x) # Similarly add a dense layer with 128 neurons</pre>
	2022-04-26 15:32:25.333550: I tensorflow/core/common_runtime/pluggable_device/pluggable_device_factory.cc:3 Could not identify NUMA node of platform GPU ID 0, defaulting to 0. Your kernel may not have been built wit MA support. 2022-04-26 15:32:25.333768: I tensorflow/core/common_runtime/pluggable_device/pluggable_device_factory.cc:2 Created TensorFlow device (/job:localhost/replica:0/task:0/device:GPU:0 with 0 MB memory) -> physical Plugg Device (device: 0, name: METAL, pci bus id: <undefined>) Executing op Mul in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AddV2 in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op VarHandleOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0</undefined>
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	input_1 (InputLayer) [(None, 150, 150, 3)] 0 block1_conv1 (Conv2D) (None, 150, 150, 64) 1792 block1_conv2 (Conv2D) (None, 150, 150, 64) 36928 block1_pool (MaxPooling2D) (None, 75, 75, 64) 0 block2_conv1 (Conv2D) (None, 75, 75, 128) 73856 block2_conv2 (Conv2D) (None, 75, 75, 128) 147584
	block2_pool (MaxPooling2D) (None, 37, 37, 128) 0 block3_conv1 (Conv2D) (None, 37, 37, 256) 295168 block3_conv2 (Conv2D) (None, 37, 37, 256) 590080 block3_conv3 (Conv2D) (None, 37, 37, 256) 590080 block3_pool (MaxPooling2D) (None, 18, 18, 256) 0 block4_conv1 (Conv2D) (None, 18, 18, 512) 1180160
	block4_conv2 (Conv2D) (None, 18, 18, 512) 2359808 block4_conv3 (Conv2D) (None, 18, 18, 512) 2359808 block4_pool (MaxPooling2D) (None, 9, 9, 512) 0 block5_conv1 (Conv2D) (None, 9, 9, 512) 2359808 block5_conv2 (Conv2D) (None, 9, 9, 512) 2359808 block5_conv3 (Conv2D) (None, 9, 9, 512) 2359808 block5_pool (MaxPooling2D) (None, 4, 4, 512) 0
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	Executing op Mul in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AddV2 in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op VarHandleOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Fill in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op VarHandleOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op RandomUniform in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Sub in device /job:localhost/replica:0/task:0/device:GPU:0
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	Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op VarHandleOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Model: "model" Layer (type) Output Shape Param #
	block1_pool (MaxPooling2D) (None, 75, 75, 64) 0 block2_conv1 (Conv2D) (None, 75, 75, 128) 73856 block2_conv2 (Conv2D) (None, 75, 75, 128) 147584 block2_pool (MaxPooling2D) (None, 37, 37, 128) 0 block3_conv1 (Conv2D) (None, 37, 37, 256) 295168 block3_conv2 (Conv2D) (None, 37, 37, 256) 590080
	block3_conv3 (Conv2D) (None, 37, 37, 256) 590080 block3_pool (MaxPooling2D) (None, 18, 18, 256) 0 block4_conv1 (Conv2D) (None, 18, 18, 512) 1180160 block4_conv2 (Conv2D) (None, 18, 18, 512) 2359808 block4_conv3 (Conv2D) (None, 18, 18, 512) 2359808 block4_pool (MaxPooling2D) (None, 9, 9, 512) 0 block5_conv1 (Conv2D) (None, 9, 9, 512) 2359808
	block5_conv1 (Conv2D) (None, 9, 9, 512) 2359808 block5_conv2 (Conv2D) (None, 9, 9, 512) 2359808 block5_conv3 (Conv2D) (None, 9, 9, 512) 2359808 block5_pool (MaxPooling2D) (None, 4, 4, 512) 0 flatten (Flatten) (None, 8192) 0 dense (Dense) (None, 64) 524352 dense_1 (Dense) (None, 32) 2080
[16]:	dense_2 (Dense) (None, 1) 33
[17]:	Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Fill in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op VarHandleOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Fill in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op VarHandleOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op VarHandleOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 # define call backs
	<pre>#callbacks = [ModelCheckpoint('.mdl_wts.hdf5', monitor='val_loss', save_best_only=True),accuracy_loss_plot] # Set a learning rate annealer callbacks = [ModelCheckpoint('.mdl_wts.hdf5', monitor='val_loss', save_best_only=True),accuracy_loss_plot] Training of model history= model.fit(X_train,y_train, batch_size=64, epochs=30,validation_data=(X_test,y_test), shuffle=True,</pre>
	0.80 - 0.78 - 0.76 - 0.74 - 0.72 - 0.70 - 0.68 - 0.66 - 0.
[20]:	23/23 - 4s - loss: 0.4444 - accuracy: 0.8138 - val_loss: 0.4836 - val_accuracy: 0.7664 - 4s/epoch - 173ms/s: # check model score score=model.evaluate(X_test,y_test) print(score) Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op RangeDataset in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op RepeatDataset in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op MapDataset in device /job:localhost/replica:0/task:0/device:CPU:0
	Executing op MapDataset in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op PrefetchDataset in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op FlatMapDataset in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op TensorDataset in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op RepeatDataset in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op ZipDataset in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op ParallelMapDatasetV2 in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op OptionsDataset in device /job:localhost/replica:0/task:0/device:CPU:0 Executing op ReadVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op ReadVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0
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	Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op _EagerConst in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op AssignVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op ReadVariableOp in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0 Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 1/19 [>
	Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0 Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 3/19 [===>] - ETA: 0s - loss: 0.4592 - accuracy: 0.7396Executing op ReadVariabled n device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0 Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 4/19 [=====>] - ETA: 0s - loss: 0.4701 - accuracy: 0.7422Executing op ReadVariabled n device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0 Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 5/19 [======>] - ETA: 0s - loss: 0.4749 - accuracy: 0.7312Executing op ReadVariabled n device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0
	Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 9/19 [=======>:] - ETA: 0s - loss: 0.4637 - accuracy: 0.7708Executing op ReadVariabled n device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0 Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 10/19 [========>:] - ETA: 0s - loss: 0.4644 - accuracy: 0.7688Executing op ReadVariabled n device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0 Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 11/19 [==========>:] - ETA: 0s - loss: 0.4717 - accuracy: 0.7614Executing op ReadVariabled n device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0 Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0
	Executing opinference_test_function_8725 in device /job:localhost/replica:0/task:0/device:GPU:0 12/19 [==========>] - ETA: 0s - loss: 0.4727 - accuracy: 0.7604Executing op ReadVariable0 n device /job:localhost/replica:0/task:0/device:GPU:0 Executing op Identity in device /job:localhost/replica:0/task:0/device:GPU:0
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		plt.figure(core on train data = ' usion matrix	<pre>", accuracy_score(y_train,y_predict)) ",f1_score(y_train,y_predict))</pre>	
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In [5]: Input In [5] \$\int \text{jupyter nbconvertto pdf notebook.ipynbtemplate classic} \$\text{SyntaxError: invalid syntax}\$	Out[22]:	Executing of Execu	p Identity in device / pinference_predict_ p ReadVariableOp in depoint in device / pinference_predict_ p ConcatV2 in device / p DeleteIterator in depoint in device / p DeleteIterator in device / p D	/job:localhost/replica:0/task:0/device:GPU:0 _function_9308 in device /job:localhost/replica:0/task:0/device:GPU:0 levice /job:localhost/replica:0/task:0/device:GPU:0 _function_9308 in device /job:localhost/replica:0/task:0/device:GPU:0 _function_9308 in device /job:localhost/replica:0/task:0/device:GPU:0 /job:localhost/replica:0/task:0/device:GPU:0 /job:localhost/replica:0/task:0/device:GPU:0 /job:localhost/replica:0/task:0/device:GPU:0 /job:localhost/replica:0/task:0/device:GPU:0 /job:localhost/replica:0/task:0/device:GPU:0 /job:localhost/replica:0/task:0/device:GPU:0 /job:localhost/replica:0/task:0/device:GPU:0 /job:localhost/replica:0/task:0/device:CPU:0 /job:localhost/replica:0/task:0/device:CPU:0 /job:localhost/replica:0/task:0/device:CPU:0 /3684210527	
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