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    {
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      "execution_count": 6,
      "metadata": {
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      "outputs": [],
      "source": [
        "import tensorflow as tf\n"
      ]
    },
    {
      "cell_type": "code",
      "execution_count": 7,
      "metadata": {},
      "outputs": [],
      "source": [
        "\n",
        "from keras.preprocessing.image import ImageDataGenerator"
      ]
    },
    {
      "cell_type": "code",
      "execution_count": null,
      "metadata": {},
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        "#Augmenting the input training images"
      ]
    }
  ]
}
```

```

},
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  "cell_type": "code",
  "execution_count": 11,
  "metadata": {},
  "outputs": [
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      "output_type": "stream",
      "text": [
        "Found 4103 images belonging to 5 classes.\n"
      ]
    }
  ],
  "source": [
    "train_datagen = ImageDataGenerator(\n",
    "    rescale=1./255,\n",
    "    shear_range=0.2,\n",
    "    zoom_range=0.2,\n",
    "    horizontal_flip=True)\n",
    "\n",
    "\n",
    "training_set = train_datagen.flow_from_directory(\n",
    "    'training',\n",
    "    target_size=(64, 64),\n",
    "    batch_size=32,\n",
    "    class_mode='categorical')\n",
    "\n"
  ]
},
{

```

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"cell_type": "code",
"execution_count": 12,
"metadata": {},
"outputs": [
  {
    "name": "stdout",
    "output_type": "stream",
    "text": [
      "Found 214 images belonging to 5 classes.\n"
    ]
  }
],
"source": [
  "test_datagen = ImageDataGenerator(\n",
  "    rescale=1./255)\n",
  "\n",
  "test_data = test_datagen.flow_from_directory(\n",
  "    'Testing',\n",
  "    target_size=(64, 64),\n",
  "    batch_size=32,\n",
  "    class_mode='categorical')\n",
  ],
},
{
  "cell_type": "code",
  "execution_count": null,
  "metadata": {},
  "outputs": [],
  "source": [
    "#Building the model"
  ]
}

```

```

},
{
  "cell_type": "code",
  "execution_count": 13,
  "metadata": {},
  "outputs": [],
  "source": [
    "cnn = tf.keras.models.Sequential()"
  ]
},
{
  "cell_type": "code",
  "execution_count": null,
  "metadata": {},
  "outputs": [],
  "source": [
    "#Adding convolution layer"
  ]
},
{
  "cell_type": "code",
  "execution_count": 14,
  "metadata": {},
  "outputs": [],
  "source": [
    "cnn.add(tf.keras.layers.Conv2D(filters=64,kernel_size=3,activation =\"relu\",input_shape
    =[64,64,3]))\n",
    "\n",
    "cnn.add(tf.keras.layers.MaxPool2D(pool_size = 2,strides=2))"
  ]
},

```

```

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  "execution_count": 15,
  "metadata": {},
  "outputs": [],
  "source": [
    "cnn.add(tf.keras.layers.Conv2D(filters=64,kernel_size=3,activation =\"relu\")\\n",
    "\\n",
    "cnn.add(tf.keras.layers.MaxPool2D(pool_size = 2,strides=2))"
  ]
},
{
  "cell_type": "code",
  "execution_count": 16,
  "metadata": {},
  "outputs": [],
  "source": [
    "cnn.add(tf.keras.layers.Dropout(0.5))"
  ]
},
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  "cell_type": "code",
  "execution_count": null,
  "metadata": {},
  "outputs": [],
  "source": [
    "# Flattening the layers "
  ]
},
{
  "cell_type": "code",

```

```
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"metadata": {},  
"outputs": [],  
"source": [  
    "cnn.add(tf.keras.layers.Flatten())"  
]  
,  
{  
    "cell_type": "code",  
    "execution_count": null,  
    "metadata": {},  
    "outputs": [],  
    "source": [  
        "# Adding dense layers(Hidden Layers)"  
    ]  
},  
{  
    "cell_type": "code",  
    "execution_count": 18,  
    "metadata": {},  
    "outputs": [],  
    "source": [  
        "cnn.add(tf.keras.layers.Dense(units=128 ,activation =\"relu\"))"  
    ]  
},  
{  
    "cell_type": "code",  
    "execution_count": 19,  
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    "outputs": [],  
    "source": [  

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```

    "cnn.add(tf.keras.layers.Dense(units=5,activation=\"softmax\"))"
  ]
},
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  "cell_type": "code",
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  "metadata": {},
  "outputs": [],
  "source": [
    "#compilation of the neural network model"
  ]
},
{
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  "metadata": {},
  "outputs": [],
  "source": [
    "cnn.compile(optimizer=\"rmsprop\",loss=\"categorical_crossentropy\",metrics=[\"accuracy\"])"
  ]
},
{
  "cell_type": "code",
  "execution_count": null,
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  "outputs": [],
  "source": [
    "#Fitting the neural network model and training it"
  ]
},
{

```

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  "scrolled": false
},
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      "Epoch 1/30\n",
      "129/129 [=====] - 34s 254ms/step - loss: 1.3400 - accuracy: 0.4350 - val_loss: 1.0596 - val_accuracy: 0.6168\n",
      "Epoch 2/30\n",
      "129/129 [=====] - 33s 253ms/step - loss: 1.0957 - accuracy: 0.5659 - val_loss: 1.1546 - val_accuracy: 0.6168\n",
      "Epoch 3/30\n",
      "129/129 [=====] - 36s 279ms/step - loss: 0.9823 - accuracy: 0.6176 - val_loss: 1.0383 - val_accuracy: 0.5841\n",
      "Epoch 4/30\n",
      "129/129 [=====] - 37s 285ms/step - loss: 0.9194 - accuracy: 0.6432 - val_loss: 0.8612 - val_accuracy: 0.6776\n",
      "Epoch 5/30\n",
      "129/129 [=====] - 37s 289ms/step - loss: 0.8707 - accuracy: 0.6727 - val_loss: 1.1994 - val_accuracy: 0.5514\n",
      "Epoch 6/30\n",
      "129/129 [=====] - 41s 315ms/step - loss: 0.8155 - accuracy: 0.6856 - val_loss: 0.9825 - val_accuracy: 0.6916\n",
      "Epoch 7/30\n",
      "129/129 [=====] - 37s 285ms/step - loss: 0.7836 - accuracy: 0.7002 - val_loss: 0.9143 - val_accuracy: 0.6636\n",
      "Epoch 8/30\n",
      "129/129 [=====] - 36s 280ms/step - loss: 0.7603 - accuracy: 0.7090 - val_loss: 0.8084 - val_accuracy: 0.7243\n",
```



"Epoch 9/30\n",  
"129/129 [=====] - 33s 257ms/step - loss: 0.7361 - accuracy:  
0.7187 - val\_loss: 0.8042 - val\_accuracy: 0.7150\n",  
"Epoch 10/30\n",  
"129/129 [=====] - 32s 250ms/step - loss: 0.6901 - accuracy:  
0.7387 - val\_loss: 0.9286 - val\_accuracy: 0.6589\n",  
"Epoch 11/30\n",  
"129/129 [=====] - 35s 273ms/step - loss: 0.6722 - accuracy:  
0.7453 - val\_loss: 1.0362 - val\_accuracy: 0.6822\n",  
"Epoch 12/30\n",  
"129/129 [=====] - 35s 270ms/step - loss: 0.6659 - accuracy:  
0.7534 - val\_loss: 0.7733 - val\_accuracy: 0.7056\n",  
"Epoch 13/30\n",  
"129/129 [=====] - 34s 261ms/step - loss: 0.6291 - accuracy:  
0.7655 - val\_loss: 0.8955 - val\_accuracy: 0.6916\n",  
"Epoch 14/30\n",  
"129/129 [=====] - 37s 284ms/step - loss: 0.6128 - accuracy:  
0.7702 - val\_loss: 0.9361 - val\_accuracy: 0.6542\n",  
"Epoch 15/30\n",  
"129/129 [=====] - 36s 279ms/step - loss: 0.5988 - accuracy:  
0.7780 - val\_loss: 0.8789 - val\_accuracy: 0.6916\n",  
"Epoch 16/30\n",  
"129/129 [=====] - 36s 281ms/step - loss: 0.5822 - accuracy:  
0.7775 - val\_loss: 0.9812 - val\_accuracy: 0.6729\n",  
"Epoch 17/30\n",  
"129/129 [=====] - 38s 298ms/step - loss: 0.5802 - accuracy:  
0.7870 - val\_loss: 0.8973 - val\_accuracy: 0.7056\n",  
"Epoch 18/30\n",  
"129/129 [=====] - 40s 306ms/step - loss: 0.5724 - accuracy:  
0.7875 - val\_loss: 0.8542 - val\_accuracy: 0.7056\n",  
"Epoch 19/30\n",  
"129/129 [=====] - 39s 305ms/step - loss: 0.5624 - accuracy:  
0.7955 - val\_loss: 0.7468 - val\_accuracy: 0.7430\n",  
"Epoch 20/30\n",

```
"129/129 [=====] - 39s 303ms/step - loss: 0.5542 - accuracy:
0.7919 - val_loss: 0.8988 - val_accuracy: 0.7150\n",

"Epoch 21/30\n",

"129/129 [=====] - 43s 329ms/step - loss: 0.5241 - accuracy:
0.8040 - val_loss: 1.0677 - val_accuracy: 0.6963\n",

"Epoch 22/30\n",

"129/129 [=====] - 38s 296ms/step - loss: 0.5146 - accuracy:
0.8172 - val_loss: 0.8774 - val_accuracy: 0.7243\n",

"Epoch 23/30\n",

"129/129 [=====] - 39s 302ms/step - loss: 0.5153 - accuracy:
0.8172 - val_loss: 0.8348 - val_accuracy: 0.6963\n",

"Epoch 24/30\n",

"129/129 [=====] - 45s 348ms/step - loss: 0.5067 - accuracy:
0.8153 - val_loss: 0.9380 - val_accuracy: 0.6916\n",

"Epoch 25/30\n",

"129/129 [=====] - 44s 342ms/step - loss: 0.4726 - accuracy:
0.8284 - val_loss: 0.9572 - val_accuracy: 0.7056\n",

"Epoch 26/30\n",

"129/129 [=====] - 41s 318ms/step - loss: 0.4762 - accuracy:
0.8360 - val_loss: 0.8506 - val_accuracy: 0.7056\n",

"Epoch 27/30\n",

"129/129 [=====] - 39s 302ms/step - loss: 0.4734 - accuracy:
0.8216 - val_loss: 1.2935 - val_accuracy: 0.6168\n",

"Epoch 28/30\n",

"129/129 [=====] - 39s 300ms/step - loss: 0.4611 - accuracy:
0.8272 - val_loss: 0.8751 - val_accuracy: 0.6869\n",

"Epoch 29/30\n",

"129/129 [=====] - 37s 290ms/step - loss: 0.4375 - accuracy:
0.8372 - val_loss: 0.9651 - val_accuracy: 0.6729\n",

"Epoch 30/30\n",

"129/129 [=====] - 39s 299ms/step - loss: 0.4292 - accuracy:
0.8501 - val_loss: 1.0778 - val_accuracy: 0.6963\n"

]

},

{
```

```

"data": {
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  ]
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"execution_count": 41,
"metadata": {},
"output_type": "execute_result"
}
],
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]
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      "text": [
        "Epoch 1/30\n",
        "129/129 [=====] - 45s 347ms/step - loss: 0.4250 - accuracy: 0.8496 - val_loss: 0.9867 - val_accuracy: 0.6729\n",
        "Epoch 2/30\n",
        "129/129 [=====] - 44s 341ms/step - loss: 0.4170 - accuracy: 0.8469 - val_loss: 1.0115 - val_accuracy: 0.7056\n",
        "Epoch 3/30\n",
        "129/129 [=====] - 44s 341ms/step - loss: 0.4203 - accuracy: 0.8550 - val_loss: 0.8851 - val_accuracy: 0.7150\n",

```

"Epoch 4/30\n",  
"129/129 [=====] - 44s 341ms/step - loss: 0.4077 - accuracy:  
0.8513 - val\_loss: 1.1110 - val\_accuracy: 0.6916\n",  
"Epoch 5/30\n",  
"129/129 [=====] - 40s 309ms/step - loss: 0.3930 - accuracy:  
0.8603 - val\_loss: 1.2546 - val\_accuracy: 0.7103\n",  
"Epoch 6/30\n",  
"129/129 [=====] - 42s 327ms/step - loss: 0.4018 - accuracy:  
0.8630 - val\_loss: 0.9946 - val\_accuracy: 0.6916\n",  
"Epoch 7/30\n",  
"129/129 [=====] - 41s 313ms/step - loss: 0.3879 - accuracy:  
0.8640 - val\_loss: 1.0004 - val\_accuracy: 0.7243\n",  
"Epoch 8/30\n",  
"129/129 [=====] - 42s 324ms/step - loss: 0.3729 - accuracy:  
0.8655 - val\_loss: 1.0725 - val\_accuracy: 0.6916\n",  
"Epoch 9/30\n",  
"129/129 [=====] - 41s 319ms/step - loss: 0.3805 - accuracy:  
0.8582 - val\_loss: 1.0544 - val\_accuracy: 0.6916\n",  
"Epoch 10/30\n",  
"129/129 [=====] - 42s 327ms/step - loss: 0.3742 - accuracy:  
0.8652 - val\_loss: 0.9719 - val\_accuracy: 0.6963\n",  
"Epoch 11/30\n",  
"129/129 [=====] - 42s 326ms/step - loss: 0.3737 - accuracy:  
0.8686 - val\_loss: 0.9270 - val\_accuracy: 0.7336\n",  
"Epoch 12/30\n",  
"129/129 [=====] - 43s 334ms/step - loss: 0.3898 - accuracy:  
0.8647 - val\_loss: 0.9987 - val\_accuracy: 0.7196\n",  
"Epoch 13/30\n",  
"129/129 [=====] - 44s 338ms/step - loss: 0.3701 - accuracy:  
0.8718 - val\_loss: 0.8642 - val\_accuracy: 0.7196\n",  
"Epoch 14/30\n",  
"129/129 [=====] - 44s 339ms/step - loss: 0.3546 - accuracy:  
0.8786 - val\_loss: 1.1820 - val\_accuracy: 0.6822\n",  
"Epoch 15/30\n",

"129/129 [=====] - 50s 390ms/step - loss: 0.3510 - accuracy:  
0.8762 - val\_loss: 1.0773 - val\_accuracy: 0.7150\n",

"Epoch 16/30\n",

"129/129 [=====] - 41s 315ms/step - loss: 0.3433 - accuracy:  
0.8852 - val\_loss: 1.3577 - val\_accuracy: 0.7009\n",

"Epoch 17/30\n",

"129/129 [=====] - 68s 527ms/step - loss: 0.3400 - accuracy:  
0.8796 - val\_loss: 1.0770 - val\_accuracy: 0.7150\n",

"Epoch 18/30\n",

"129/129 [=====] - 63s 477ms/step - loss: 0.3444 - accuracy:  
0.8755 - val\_loss: 0.9273 - val\_accuracy: 0.7243\n",

"Epoch 19/30\n",

"129/129 [=====] - 70s 539ms/step - loss: 0.3386 - accuracy:  
0.8835 - val\_loss: 1.1471 - val\_accuracy: 0.6776\n",

"Epoch 20/30\n",

"129/129 [=====] - 71s 548ms/step - loss: 0.3300 - accuracy:  
0.8869 - val\_loss: 1.1275 - val\_accuracy: 0.7103\n",

"Epoch 21/30\n",

"129/129 [=====] - 77s 599ms/step - loss: 0.3330 - accuracy:  
0.8864 - val\_loss: 1.2780 - val\_accuracy: 0.6963\n",

"Epoch 22/30\n",

"129/129 [=====] - 66s 515ms/step - loss: 0.3249 - accuracy:  
0.8867 - val\_loss: 1.0580 - val\_accuracy: 0.7056\n",

"Epoch 23/30\n",

"129/129 [=====] - 82s 622ms/step - loss: 0.3225 - accuracy:  
0.8903 - val\_loss: 1.2799 - val\_accuracy: 0.7383\n",

"Epoch 24/30\n",

"129/129 [=====] - 101s 785ms/step - loss: 0.3164 - accuracy:  
0.8884 - val\_loss: 1.3724 - val\_accuracy: 0.7056\n",

"Epoch 25/30\n",

"129/129 [=====] - 50s 382ms/step - loss: 0.3218 - accuracy:  
0.8945 - val\_loss: 1.2431 - val\_accuracy: 0.7009\n",

"Epoch 26/30\n",

"129/129 [=====] - 61s 469ms/step - loss: 0.3212 - accuracy:  
0.8945 - val\_loss: 0.9750 - val\_accuracy: 0.7056\n",

```

    "Epoch 27/30\n",
    "129/129 [=====] - 111s 851ms/step - loss: 0.3087 - accuracy:
0.9020 - val_loss: 1.4106 - val_accuracy: 0.7056\n",
    "Epoch 28/30\n",
    "129/129 [=====] - 61s 466ms/step - loss: 0.3077 - accuracy:
0.8935 - val_loss: 0.9878 - val_accuracy: 0.7243\n",
    "Epoch 29/30\n",
    "129/129 [=====] - 59s 458ms/step - loss: 0.3071 - accuracy:
0.8976 - val_loss: 1.1608 - val_accuracy: 0.6963\n",
    "Epoch 30/30\n",
    "129/129 [=====] - 38s 295ms/step - loss: 0.3014 - accuracy:
0.8913 - val_loss: 1.4083 - val_accuracy: 0.7336\n"
]
},
{
    "data": {
        "text/plain": [
            "<keras.callbacks.History at 0x2bf223fcfd0>"
        ]
    },
    "execution_count": 42,
    "metadata": {},
    "output_type": "execute_result"
}
],
"source": [
    "cnn.fit(x = training_set , validation_data =test_data , epochs = 30 )"
]
},
{
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```

```

"metadata": {},
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"source": [
    "#preprocess the test image"
]
},
{
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    "outputs": [],
    "source": [
        "import numpy as np"
    ]
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    "execution_count": 55,
    "metadata": {},
    "outputs": [
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            "output_type": "stream",
            "text": [
                "1/1 [=====] - 0s 79ms/step\n"
            ]
        }
    ],
    "source": [
        "image = tf.keras.preprocessing.image.load_img(\"prediction/tu.jpg\",target_size=(64,64))\n",
        "input_arr = tf.keras.preprocessing.image.img_to_array(image)\n",

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"input_arr = np.expand_dims(input_arr,axis=0)\n",
"result = cnn.predict(input_arr)"
]
},
{
"cell_type": "code",
"execution_count": 52,
"metadata": {},
"outputs": [
{
"data": {
"text/plain": [
"{'Daisy': 0, 'Dandelion': 1, 'rose': 2, 'sunflower': 3, 'tulip': 4}"
]
},
"execution_count": 52,
"metadata": {},
"output_type": "execute_result"
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"source": [
"training_set.class_indices"
]
},
{
"cell_type": "code",
"execution_count": 56,
"metadata": {},
"outputs": [
{
"name": "stdout",

```



```
"output_type": "stream",
"text": [
  "[[0. 0. 0. 0. 1.]]\n"
]
},
],
"source": [
  "print(result)"
]
},
{
  "cell_type": "code",
  "execution_count": null,
  "metadata": {},
  "outputs": [],
  "source": [
    "#Mapping the result to the values"
  ]
},
{
  "cell_type": "code",
  "execution_count": 57,
  "metadata": {},
  "outputs": [
    {
      "name": "stdout",
      "output_type": "stream",
      "text": [
        "tulip\n"
      ]
    }
  ]
}
```

```

],
"source": [
    "if result[0][0] == 1:\n",
    "    print(\"daisy\")\n",
    "elif result[0][1] == 1:\n",
    "    print(\"dandelion\")\n",
    "elif result[0][2] == 1:\n",
    "    print(\"rose\")\n",
    "elif result[0][3] == 1:\n",
    "    print(\"sunflower\")\n",
    "elif result[0][4] == 1:\n",
    "    print(\"tulip\")\n",
    "]\n",
},
{
    "cell_type": "code",
    "execution_count": null,
    "metadata": {},
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],
"metadata": {
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        "language": "python",
        "name": "python3"
    },
    "language_info": {
        "codemirror_mode": {
            "name": "ipython",

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},
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"mimetype": "text/x-python",
"name": "python",
"nbconvert_exporter": "python",
"pygments_lexer": "ipython3",
"version": "3.7.3"
}
},
"nbformat": 4,
"nbformat_minor": 2
}
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