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       "'/home/wsuser/work'"
      ]
     },
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     "output_type": "execute_result"
    }
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    "pwd"
   ]
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 "Collecting keras==2.7.0\n",
 "  Downloading keras-2.7.0-py2.py3-none-any.whl (1.3 MB)\n",
 "\u001b[K     |████████████████████████████████| 1.3 MB 22.6 MB/s eta 0:00:01\n",
 "\u001b[?25hInstalling collected packages: keras\n",
 "  Attempting uninstall: keras\n",
 "    Found existing installation: keras 2.10.0\n",
 "    Uninstalling keras-2.10.0:\n",
 "      Successfully uninstalled keras-2.10.0\n",
 "\u001b[31mERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the source of the following dependency conflicts.\n",
 "tensorflow 2.10.0 requires keras<2.11,>=2.10.0, but you have keras 2.7.0 which is incompatible.\n",
 "tensorflow-text 2.7.3 requires tensorflow<2.8,>=2.7.0, but you have tensorflow 2.10.0 which is incompatible.\n",
 "autoai-ts-libs 1.1.9 requires tensorflow<2.8,>=2.7.0; python_version >= \"3.9\", but you have tensorflow 2.10.0 which is incompatible.\u001b[0m\n",
 "Successfully installed keras-2.7.0\n",
 "Requirement already satisfied: tensorflow==2.10.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (2.10.0)\n",
 "Requirement already satisfied: grpcio<2.0,>=1.24.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (1.42.0)\n",
 "Requirement already satisfied: opt-einsum>=2.3.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (3.3.0)\n",
 "Requirement already satisfied: absl-py>=1.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (1.3.0)\n",
 "Requirement already satisfied: numpy>=1.20 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (1.20.3)\n",
 "Requirement already satisfied: astunparse>=1.6.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (1.6.3)\n",
 "Requirement already satisfied: gast<=0.4.0,>=0.2.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (0.4.0)\n",
 "Requirement already satisfied: setuptools in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (58.0.4)\n",
```

"Requirement already satisfied: tensorboard<2.11,>=2.10 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (2.10.1)\n",

"Requirement already satisfied: google-pasta>=0.1.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (0.2.0)\n",

"Requirement already satisfied: keras-preprocessing>=1.1.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (1.1.2)\n",

"Requirement already satisfied: typing-extensions>=3.6.6 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (4.1.1)\n",

"Requirement already satisfied: flatbuffers>=2.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (2.0)\n",

"Requirement already satisfied: termcolor>=1.1.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (1.1.0)\n",

"Requirement already satisfied: h5py>=2.9.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (3.2.1)\n",

"Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (0.23.1)\n",

"Requirement already satisfied: tensorflow-estimator<2.11,>=2.10.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (2.10.0)\n",

"Requirement already satisfied: protobuf<3.20,>=3.9.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (3.19.1)\n",

"Requirement already satisfied: wrapt>=1.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (1.12.1)\n",

"Collecting keras<2.11,>=2.10.0\n",

" Using cached keras-2.10.0-py2.py3-none-any.whl (1.7 MB)\n",

"Requirement already satisfied: six>=1.12.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (1.15.0)\n",

"Requirement already satisfied: libclang>=13.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (14.0.6)\n",

"Requirement already satisfied: packaging in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorflow==2.10.0) (21.3)\n",

"Requirement already satisfied: wheel<1.0,>=0.23.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from astunparse>=1.6.0->tensorflow==2.10.0) (0.37.0)\n",

"Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard<2.11,>=2.10->tensorflow==2.10.0) (0.4.4)\n",

"Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard<2.11,>=2.10->tensorflow==2.10.0) (1.6.0)\n",

"Requirement already satisfied: markdown>=2.6.8 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard<2.11,>=2.10->tensorflow==2.10.0) (3.3.3)\n",

"Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard<2.11,>=2.10->tensorflow==2.10.0) (0.6.1)\n",

"Requirement already satisfied: werkzeug>=1.0.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard<2.11,>=2.10->tensorflow==2.10.0) (2.0.2)\n",

"Requirement already satisfied: google-auth<3,>=1.6.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard<2.11,>=2.10->tensorflow==2.10.0) (1.23.0)\n",

"Requirement already satisfied: requests<3,>=2.21.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from tensorboard<2.11,>=2.10->tensorflow==2.10.0) (2.26.0)\n",

"Requirement already satisfied: rsa<5,>=3.1.4 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from google-auth<3,>=1.6.3->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (4.7.2)\n",

"Requirement already satisfied: cachetools<5.0,>=2.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from google-auth<3,>=1.6.3->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (4.2.2)\n",

"Requirement already satisfied: pyasn1-modules>=0.2.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from google-auth<3,>=1.6.3->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (0.2.8)\n",

"Requirement already satisfied: requests-oauthlib>=0.7.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from google-auth-oauthlib<0.5,>=0.4.1->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (1.3.0)\n",

"Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (0.4.8)\n",

"Requirement already satisfied: urllib3<1.27,>=1.21.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests<3,>=2.21.0->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (1.26.7)\n",

"Requirement already satisfied: charset-normalizer~=2.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests<3,>=2.21.0->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (2.0.4)\n",

"Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests<3,>=2.21.0->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (3.3)\n",

"Requirement already satisfied: certifi>=2017.4.17 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests<3,>=2.21.0->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (2022.9.24)\n",

"Requirement already satisfied: oauthlib>=3.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard<2.11,>=2.10->tensorflow==2.10.0) (3.2.1)\n",

"Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from packaging->tensorflow==2.10.0) (3.0.4)\n",

"Installing collected packages: keras\n",

" Attempting uninstall: keras\n",

"   Found existing installation: keras 2.7.0\n",

"   Uninstalling keras-2.7.0:\n",

"   Successfully uninstalled keras-2.7.0\n",

"\u001b[31mERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the source of the following dependency conflicts.\n",

"tensorflow-text 2.7.3 requires tensorflow<2.8,>=2.7.0, but you have tensorflow 2.10.0 which is incompatible.\n",

"autoai-ts-libs 1.1.9 requires tensorflow<2.8,>=2.7.0; python_version >= \"3.9\", but you have tensorflow 2.10.0 which is incompatible.\u001b[0m\n",

"Successfully installed keras-2.10.0\n"

]

}

],

"source": [

"!pip install keras==2.7.0\n",

"!pip install tensorflow==2.10.0"

]

},

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"metadata": {},

"outputs": [],

"source": [

"#import keras libraries\n",

"from keras.models import Sequential #api,se\n",

"from keras.layers import Dense #add layers\n",

"from keras.layers import Convolution2D #con\n",

```
   "from keras.layers import MaxPooling2D\n",
   "from keras.layers import Flatten"
  ]
 },
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  "execution_count": 9,
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  },
  "outputs": [],
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   "#image preprocessing(or) image augmentation\n",
   "from keras.preprocessing.image import ImageDataGenerator"
  ]
 },
 {
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  "execution_count": 10,
  "metadata": {
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  },
  "outputs": [],
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ImageDataGenerator(rescale=1./255,shear_range=0.2,zoom_range=0.2,horizontal_flip=True,vertical
_flip=True)\n",
   "#rescale => rescaling pixel value from 0 to 255 to 0 to 1\n",
   "#shear_range=> counter clock wise rotation(anti clock)"
  ]
 },
 {
```

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  ]
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  "metadata": {},
  "outputs": [],
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   "\n",
   "import os, types\n",
   "import pandas as pd\n",
   "from botocore.client import Config\n",
   "import ibm_boto3\n",
   "\n",
   "def __iter__(self): return 0\n",
   "\n",
   "# @hidden_cell\n",
   "# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.\n",
   "# You might want to remove those credentials before you share the notebook.\n",
   "cos_client = ibm_boto3.client(service_name='s3',\n",
   "    ibm_api_key_id='6L2of0JKTob3sCgpaW9F6IcVfD7HJNHrn9Owefk-q5wo',\n",
   "    ibm_auth_endpoint=\"https://iam.cloud.ibm.com/oidc/token\",\n",
```

```
    "    config=Config(signature_version='oauth'),\n",
    "    endpoint_url='https://s3.private.us.cloud-object-storage.appdomain.cloud')\n",
    "\n",
    "bucket = 'imageclassification-donotdelete-pr-fleoxflx4ga1rw'\n",
    "object_key = 'Dataset-20221107T052301Z-001.zip'\n",
    "\n",
    "streaming_body_1 = cos_client.get_object(Bucket=bucket, Key=object_key)['Body']\n",
    "\n",
    "# Your data file was loaded into a botocore.response.StreamingBody object.\n",
    "# Please read the documentation of ibm_boto3 and pandas to learn more about the possibilities to load the data.\n",
    "# ibm_boto3 documentation: https://ibm.github.io/ibm-cos-sdk-python/\n",
    "# pandas documentation: http://pandas.pydata.org/\n"
   ]
  },
  {
   "cell_type": "code",
   "execution_count": 13,
   "metadata": {},
   "outputs": [],
   "source": [
    "from io import BytesIO\n",
    "import zipfile\n",
    "unzip=zipfile.ZipFile(BytesIO(streaming_body_1.read()),'r')\n",
    "file_paths=unzip.namelist()\n",
    "for path in file_paths:\n",
    "    unzip.extract(path)"
   ]
  },
  {
   "cell_type": "code",
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   "output_type": "stream",
   "text": [
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   ]
  }
 ],
 "source": [
  "ls"
 ]
},
{
 "cell_type": "code",
 "execution_count": 15,
 "metadata": {},
 "outputs": [
  {
   "data": {
    "text/plain": [
     "'/home/wsuser/work'"
    ]
   },
   "execution_count": 15,
   "metadata": {},
   "output_type": "execute_result"
  }
 ],
```

```
 "source": [
  "pwd"
 ]
},
{
 "cell_type": "code",
 "execution_count": 16,
 "metadata": {},
 "outputs": [],
 "source": [
  "import os \n",
  "filenames = os.listdir('/home/wsuser/work/Dataset')"
 ]
},
{
 "cell_type": "code",
 "execution_count": 17,
 "metadata": {
  "colab": {
   "base_uri": "https://localhost:8080/"
  },
  "id": "ltTuui5Kqdtp",
  "outputId": "2f168c3f-c51e-4c92-dc28-3d4ea011d4da"
 },
 "outputs": [
  {
   "name": "stdout",
   "output_type": "stream",
   "text": [
    "Found 4118 images belonging to 5 classes.\n"
   ]
```

```
   }
  ],
  "source": [
   "x_train =
train_datagen.flow_from_directory(\"/home/wsuser/work/Dataset/TRAIN_SET\",target_size=(64,64
),batch_size=32,class_mode=\"categorical\")"
  ]
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  "metadata": {
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   "outputId": "87f6e98f-1cba-473a-b803-faa60d4eeb7d"
  },
  "outputs": [
   {
    "name": "stdout",
    "output_type": "stream",
    "text": [
     "Found 929 images belonging to 5 classes.\n"
    ]
   }
  ],
  "source": [
   "x_test =
test_datagen.flow_from_directory(\"/home/wsuser/work/Dataset/TEST_SET\",target_size=(64,64),b
atch_size=32,class_mode=\"categorical\")"
  ]
```

```
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  },
  "id": "bApCdADGup8T",
  "outputId": "d57ab51e-f9c3-47b2-f19c-f25f10a7aec7"
 },
 "outputs": [
  {
   "data": {
    "text/plain": [
     "{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}"
    ]
   },
   "execution_count": 19,
   "metadata": {},
   "output_type": "execute_result"
  }
 ],
 "source": [
  "x_train.class_indices"
 ]
},
{
 "cell_type": "code",
 "execution_count": 20,
 "metadata": {
```

```
 "colab": {
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 },
 "id": "9A3kmlgHz0Q7",
 "outputId": "d2e6daaa-dbe2-4552-ef65-d5e8bbe0d9ea"
},
"outputs": [
 {
  "name": "stdout",
  "output_type": "stream",
  "text": [
   "{'APPLES': 0, 'BANANA': 1, 'ORANGE': 2, 'PINEAPPLE': 3, 'WATERMELON': 4}\n"
  ]
 }
],
"source": [
 "#checking the number of classes\n",
 "print(x_test.class_indices)"
]
},
{
 "cell_type": "code",
 "execution_count": 21,
 "metadata": {
  "colab": {
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  },
  "id": "yGeKS68E0bSP",
  "outputId": "cd5bac4d-ffb6-464b-d6f0-841ef62e776d"
 },
 "outputs": [
```

```
 {
  "data": {
   "text/plain": [
    "Counter({0: 995, 1: 1354, 2: 1019, 3: 275, 4: 475})"
   ]
  },
  "execution_count": 21,
  "metadata": {},
  "output_type": "execute_result"
 }
],
"source": [
 "from collections import Counter as c\n",
 "c(x_train .labels)"
]
},
{
 "cell_type": "code",
 "execution_count": 22,
 "metadata": {
  "id": "dx_5gTSAu0hY"
 },
 "outputs": [],
 "source": [
  "#Initializing the model\n",
  "model = Sequential()"
 ]
},
{
 "cell_type": "code",
 "execution_count": 23,
```

```
 "metadata": {
  "id": "ufSbk5LVu9qU"
 },
 "outputs": [],
 "source": [
  "# add First convolution layer"
 ]
},
{
 "cell_type": "code",
 "execution_count": 24,
 "metadata": {
  "id": "62dYvr9WvHlF"
 },
 "outputs": [],
 "source": [
  "model.add(Convolution2D(32,(3,3),input_shape=(64,64,3),activation=\"relu\"))\n",
  "# 32 indicates => no of feature detectors\n",
  "#(3,3)=> kernel size (feature detector size)"
 ]
},
{
 "cell_type": "code",
 "execution_count": 25,
 "metadata": {
  "id": "0RoS09jlvROB"
 },
 "outputs": [],
 "source": [
  "# add Maxpooling layer"
 ]
```

```
},
{
 "cell_type": "code",
 "execution_count": 26,
 "metadata": {
  "id": "7tIjlFq_vaMc"
 },
 "outputs": [],
 "source": [
  "model.add(MaxPooling2D(pool_size=(2,2)))"
 ]
},
{
 "cell_type": "code",
 "execution_count": 27,
 "metadata": {
  "id": "lnioOB-s9CaM"
 },
 "outputs": [],
 "source": [
  "#Second convolution layer and pooling\n",
  "model.add(Convolution2D(32,(3,3),activation='relu'))"
 ]
},
{
 "cell_type": "code",
 "execution_count": 28,
 "metadata": {
  "id": "bAcEug9x-Rqm"
 },
 "outputs": [],
```

```
 "source": [
  "model.add(MaxPooling2D(pool_size=(2,2)))"
 ]
},
{
 "cell_type": "code",
 "execution_count": 29,
 "metadata": {
  "id": "hFOgQQQb_Inn"
 },
 "outputs": [],
 "source": [
  "#Flattening the layers\n",
  "model.add(Flatten())"
 ]
},
{
 "cell_type": "code",
 "execution_count": 30,
 "metadata": {
  "id": "v1LSVWYs_g2v"
 },
 "outputs": [],
 "source": [
  "model.add(Dense(units=128,activation='relu'))"
 ]
},
{
 "cell_type": "code",
 "execution_count": 31,
 "metadata": {
```

```
  "id": "DKg4TBZZ_zT6"
 },
 "outputs": [],
 "source": [
  "model.add(Dense(units=5,activation='softmax'))"
 ]
},
{
 "cell_type": "code",
 "execution_count": 32,
 "metadata": {
  "id": "eCB4ZIxOvh4G"
 },
 "outputs": [],
 "source": [
  "# add flatten layer => input to your ANN"
 ]
},
{
 "cell_type": "code",
 "execution_count": 33,
 "metadata": {
  "id": "agjb4SXivnq_"
 },
 "outputs": [],
 "source": [
  "model.add(Flatten())"
 ]
},
{
 "cell_type": "code",
```

```
 "execution_count": 34,
 "metadata": {},
 "outputs": [],
 "source": [
  "model.add(Dense(units=128,kernel_initializer=\"random_uniform\",activation=\"relu\"))"
 ]
},
{
 "cell_type": "code",
 "execution_count": 35,
 "metadata": {},
 "outputs": [],
 "source": [
  "model.add(Dense(units=5,kernel_initializer=\"random_uniform\",activation=\"softmax\"))\n"
 ]
},
{
 "cell_type": "code",
 "execution_count": 36,
 "metadata": {},
 "outputs": [],
 "source": [
  "#compile the model\n",
  "model.compile(loss=\"categorical_crossentropy\",optimizer=\"adam\",metrics=[\"accuracy\"])"
 ]
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{
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```
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   "#Train the model"
  ]
 },
 {
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    "output_type": "stream",
    "text": [
     "Epoch 1/10\n"
    ]
   },
   {
    "name": "stderr",
    "output_type": "stream",
    "text": [
     "/tmp/wsuser/ipykernel_164/4170907729.py:1: UserWarning: `Model.fit_generator` is deprecated and will be removed in a future version. Please use `Model.fit`, which supports generators.\n",
     "  model.fit_generator(x_train,steps_per_epoch = 47 ,epochs = 10,validation_data = x_test,validation_steps = 10)\n"
    ]
   },
   {
    "name": "stdout",
    "output_type": "stream",
```

```
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"47/47 [==============================] - 10s 220ms/step - loss: 1.4920 - accuracy: 0.3271 - val_loss: 1.2936 - val_accuracy: 0.4062\n",
"Epoch 2/10\n",
"47/47 [==============================] - 10s 219ms/step - loss: 1.4914 - accuracy: 0.3205 - val_loss: 1.2874 - val_accuracy: 0.4656\n",
"Epoch 3/10\n",
"47/47 [==============================] - 10s 218ms/step - loss: 1.4792 - accuracy: 0.3307 - val_loss: 1.2546 - val_accuracy: 0.4781\n",
"Epoch 4/10\n",
"47/47 [==============================] - 11s 234ms/step - loss: 1.4971 - accuracy: 0.3273 - val_loss: 1.2869 - val_accuracy: 0.4531\n",
"Epoch 5/10\n",
"47/47 [==============================] - 10s 221ms/step - loss: 1.4939 - accuracy: 0.3178 - val_loss: 1.2880 - val_accuracy: 0.4719\n",
"Epoch 6/10\n",
"47/47 [==============================] - 10s 217ms/step - loss: 1.4852 - accuracy: 0.3178 - val_loss: 1.2793 - val_accuracy: 0.4375\n",
"Epoch 7/10\n",
"47/47 [==============================] - 10s 222ms/step - loss: 1.4894 - accuracy: 0.3260 - val_loss: 1.2865 - val_accuracy: 0.4156\n",
"Epoch 8/10\n",
"47/47 [==============================] - 10s 220ms/step - loss: 1.4987 - accuracy: 0.3211 - val_loss: 1.2744 - val_accuracy: 0.4750\n",
"Epoch 9/10\n",
"47/47 [==============================] - 11s 224ms/step - loss: 1.4952 - accuracy: 0.3220 - val_loss: 1.3020 - val_accuracy: 0.4156\n",
"Epoch 10/10\n",
"47/47 [==============================] - 11s 223ms/step - loss: 1.4679 - accuracy: 0.3391 - val_loss: 1.2756 - val_accuracy: 0.4156\n"
]
},
{
"data": {
```

```
    "text/plain": [
     "<keras.callbacks.History at 0x7fec605ddee0>"
    ]
   },
   "execution_count": 45,
   "metadata": {},
   "output_type": "execute_result"
  }
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  "model.fit_generator(x_train,steps_per_epoch = 47 ,epochs = 10,validation_data = x_test,validation_steps = 10)\n",
   "#steps_per_epoch = no of train images/batch size\n",
   "#validation_steps = no of test images/batch size"
 ]
},
{
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  "id": "5nrwRs8k5rSf"
 },
 "outputs": [],
 "source": [
  "model.save(\"nutrition.h5\")"
 ]
},
{
 "cell_type": "code",
 "execution_count": 47,
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```

```
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  "output_type": "stream",
  "text": [
   "nutrition.h5\r\n"
  ]
 }
],
"source": [
 "!tar -zcvf image-classification-model_new.tgz nutrition.h5"
]
},
{
 "cell_type": "code",
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   "text": [
    "\u001b[0m\u001b[01;34mDataset\u001b[0m/\r\n",
    "image-classification-model_new.tgz\r\n",
    "nutrition.h5\r\n"
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  }
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 "source": [
  "ls -1"
 ]
```

```
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  "metadata": {},
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    "output_type": "stream",
    "text": [
     "Collecting watson-machine-learning-client\n",
     "  Downloading watson_machine_learning_client-1.0.391-py3-none-any.whl (538 kB)\n",
     "\u001b[K     |████████████████████████████████| 538 kB 20.1 MB/s eta 0:00:01\n",
     "\u001b[?25hRequirement already satisfied: ibm-cos-sdk in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (2.11.0)\n",
     "Requirement already satisfied: certifi in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (2022.9.24)\n",
     "Requirement already satisfied: tabulate in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (0.8.9)\n",
     "Requirement already satisfied: requests in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (2.26.0)\n",
     "Requirement already satisfied: lomond in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (0.3.3)\n",
     "Requirement already satisfied: tqdm in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (4.62.3)\n",
     "Requirement already satisfied: boto3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (1.18.21)\n",
     "Requirement already satisfied: urllib3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (1.26.7)\n",
     "Requirement already satisfied: pandas in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from watson-machine-learning-client) (1.3.4)\n",
     "Requirement already satisfied: s3transfer<0.6.0,>=0.5.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (0.5.0)\n",
```

"Requirement already satisfied: botocore<1.22.0,>=1.21.21 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (1.21.41)\n",

"Requirement already satisfied: jmespath<1.0.0,>=0.7.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from boto3->watson-machine-learning-client) (0.10.0)\n",

"Requirement already satisfied: python-dateutil<3.0.0,>=2.1 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from botocore<1.22.0,>=1.21.21->boto3->watson-machine-learning-client) (2.8.2)\n",

"Requirement already satisfied: six>=1.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from python-dateutil<3.0.0,>=2.1->botocore<1.22.0,>=1.21.21->boto3->watson-machine-learning-client) (1.15.0)\n",

"Requirement already satisfied: ibm-cos-sdk-s3transfer==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0)\n",

"Requirement already satisfied: ibm-cos-sdk-core==2.11.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from ibm-cos-sdk->watson-machine-learning-client) (2.11.0)\n",

"Requirement already satisfied: idna<4,>=2.5 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->watson-machine-learning-client) (3.3)\n",

"Requirement already satisfied: charset-normalizer~=2.0.0 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from requests->watson-machine-learning-client) (2.0.4)\n",

"Requirement already satisfied: pytz>=2017.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client) (2021.3)\n",

"Requirement already satisfied: numpy>=1.17.3 in /opt/conda/envs/Python-3.9/lib/python3.9/site-packages (from pandas->watson-machine-learning-client) (1.20.3)\n",

"Installing collected packages: watson-machine-learning-client\n",

"Successfully installed watson-machine-learning-client-1.0.391\n"

]

}

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"!pip install watson-machine-learning-client"

]

},

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 "    \"url\":\"https://us-south.ml.cloud.ibm.com\",\n",
 "    \"apikey\":\"BPFGcOrCf3sroRy3uKOPGozsmIL-5oVDv4A_lru2IpMS\"\n",
 "    \n",
 "}\n",
 "\n",
 "client=APIClient(wml_credentials)"
]
},
{
 "cell_type": "code",
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    "text/plain": [
     "<ibm_watson_machine_learning.client.APIClient at 0x7fec60578040>"
    ]
   },
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   "metadata": {},
   "output_type": "execute_result"
  }
 ],
 "source": [
  "client"
 ]
```

```
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   "execution_count": 52,
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   "source": [
    " def guid_from_space_name(client, space_name):\n",
    "     space=client.spaces.get_details()\n",
    "     #print(space)\n",
    "     return(next(item for item in space['resources'] if item['entity']['name']== space_name)['metadata']['id'])"
   ]
  },
  {
   "cell_type": "code",
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   "metadata": {},
   "outputs": [
    {
     "name": "stdout",
     "output_type": "stream",
     "text": [
      "Space UID =ba02adea-7e10-4237-81e7-eaf084fe4102\n"
     ]
    }
   ],
   "source": [
    "space_uid=guid_from_space_name(client,'imageclassification') #imageclassification is the deployment space name\n",
    "print(\"Space UID =\"+space_uid)"
   ]
```

```
},
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     "'SUCCESS'"
    ]
   },
   "execution_count": 54,
   "metadata": {},
   "output_type": "execute_result"
  }
 ],
 "source": [
  "client.set.default_space(space_uid)"
 ]
},
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 "cell_type": "code",
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"kernel-spark3.2-scala2.12 020d69ce-7ac1-5e68-ac1a-31189867356a base\n",

"pytorch-onnx_1.3-py3.7-edt 069ea134-3346-5748-b513-49120e15d288 base\n",

"scikit-learn_0.20-py3.6 09c5a1d0-9c1e-4473-a344-eb7b665ff687 base\n",

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"ai-function_0.1-py3.6 0cdb0f1e-5376-4f4d-92dd-da3b69aa9bda base\n",

"shiny-r3.6 0e6e79df-875e-4f24-8ae9-62dcc2148306 base\n",

"tensorflow_2.4-py3.7-horovod 1092590a-307d-563d-9b62-4eb7d64b3f22 base\n",

"pytorch_1.1-py3.6 10ac12d6-6b30-4ccd-8392-3e922c096a92 base\n",

"tensorflow_1.15-py3.6-ddl 111e41b3-de2d-5422-a4d6-bf776828c4b7 base\n",

"runtime-22.1-py3.9 12b83a17-24d8-5082-900f-0ab31fbfd3cb base\n",

"scikit-learn_0.22-py3.6 154010fa-5b3b-4ac1-82af-4d5ee5abbc85 base\n",

"default_r3.6 1b70aec3-ab34-4b87-8aa0-a4a3c8296a36 base\n",

"pytorch-onnx_1.3-py3.6 1bc6029a-cc97-56da-b8e0-39c3880dbbe7 base\n",

"kernel-spark3.3-r3.6 1c9e5454-f216-59dd-a20e-474a5cdf5988 base\n",

"pytorch-onnx_rt22.1-py3.9-edt 1d362186-7ad5-5b59-8b6c-9d0880bde37f base\n",

"tensorflow_2.1-py3.6 1eb25b84-d6ed-5dde-b6a5-3fbdf1665666 base\n",

"spark-mllib_3.2 20047f72-0a98-58c7-9ff5-a77b012eb8f5 base\n",

"tensorflow_2.4-py3.8-horovod 217c16f6-178f-56bf-824a-b19f20564c49 base\n",

"runtime-22.1-py3.9-cuda 26215f05-08c3-5a41-a1b0-da66306ce658 base\n",

"do_py3.8 295addb5-9ef9-547e-9bf4-92ae3563e720 base\n",

"autoai-ts_3.8-py3.8 2aa0c932-798f-5ae9-abd6-15e0c2402fb5 base\n",

"tensorflow_1.15-py3.6 2b73a275-7cbf-420b-a912-eae7f436e0bc base\n",

"kernel-spark3.3-py3.9 2b7961e2-e3b1-5a8c-a491-482c8368839a base\n",

"pytorch_1.2-py3.6 2c8ef57d-2687-4b7d-acce-01f94976dac1 base\n",

"spark-mllib_2.3 2e51f700-bca0-4b0d-88dc-5c6791338875 base\n",

"pytorch-onnx_1.1-py3.6-edt 32983cea-3f32-4400-8965-dde874a8d67e base\n",

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   "xgboost_0.82-py3.6           39e31acd-5f30-41dc-ae44-60233c80306e  base\n",
   "pytorch-onnx_1.2-py3.6-edt    40589d0e-7019-4e28-8daa-fb03b6f4fe12  base\n",
   "default_r36py38               41c247d3-45f8-5a71-b065-8580229facf0  base\n",
   "autoai-ts_rt22.1-py3.9        4269d26e-07ba-5d40-8f66-2d495b0c71f7  base\n",
   "autoai-obm_3.0                42b92e18-d9ab-567f-988a-4240ba1ed5f7  base\n",
   "pmml-3.0_4.3                  493bcb95-16f1-5bc5-bee8-81b8af80e9c7  base\n",
   "spark-mllib_2.4-r_3.6         49403dff-92e9-4c87-a3d7-a42d0021c095  base\n",
   "xgboost_0.90-py3.6            4ff8d6c2-1343-4c18-85e1-689c965304d3  base\n",
   "pytorch-onnx_1.1-py3.6        50f95b2a-bc16-43bb-bc94-b0bed208c60b  base\n",
   "autoai-ts_3.9-py3.8           52c57136-80fa-572e-8728-a5e7cbb42cde  base\n",
   "spark-mllib_2.4-scala_2.11    55a70f99-7320-4be5-9fb9-9edb5a443af5  base\n",
   "spark-mllib_3.0               5c1b0ca2-4977-5c2e-9439-ffd44ea8ffe9  base\n",
   "autoai-obm_2.0                5c2e37fa-80b8-5e77-840f-d912469614ee  base\n",
   "spss-modeler_18.1             5c3cad7e-507f-4b2a-a9a3-ab53a21dee8b  base\n",
   "cuda-py3.8                    5d3232bf-c86b-5df4-a2cd-7bb870a1cd4e  base\n",
   "autoai-kb_3.1-py3.7           632d4b22-10aa-5180-88f0-f52dfb6444d7  base\n",
   "pytorch-onnx_1.7-py3.8        634d3cdc-b562-5bf9-a2d4-ea90a478456b  base\n",
   "spark-mllib_2.3-r_3.6         6586b9e3-ccd6-4f92-900f-0f8cb2bd6f0c  base\n",
   "tensorflow_2.4-py3.7          65e171d7-72d1-55d9-8ebb-f813d620c9bb  base\n",
   "spss-modeler_18.2             687eddc9-028a-4117-b9dd-e57b36f1efa5  base\n",
   "------------------------------  ------------------------------------  ----\n",
   "Note: Only first 50 records were displayed. To display more use 'limit' parameter.\n"
  ]
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],
"source": [
 "client.software_specifications.list()"
]
},
{
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```

```
  "execution_count": 56,
  "metadata": {},
  "outputs": [],
  "source": [
   "software_space_uid=client.software_specifications.get_uid_by_name('tensorflow_rt22.1-
py3.9')"
  ]
 },
 {
  "cell_type": "code",
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     "text/plain": [
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     ]
    },
    "execution_count": 57,
    "metadata": {},
    "output_type": "execute_result"
   }
  ],
  "source": [
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  ]
 },
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  "cell_type": "code",
  "execution_count": 58,
```

```
  "metadata": {},
  "outputs": [],
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   "model_details=client.repository.store_model(model='image-classification-
model_new.tgz',meta_props={\n",
   "    client.repository.ModelMetaNames.NAME:\"CNN\",\n",
   "    client.repository.ModelMetaNames.TYPE:'tensorflow_2.7',\n",
   "    client.repository.ModelMetaNames.SOFTWARE_SPEC_UID:software_space_uid}\n",
   "                                    )\n",
   "model_id = client.repository.get_model_id(model_details)"
  ]
 },
 {
  "cell_type": "code",
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  "metadata": {},
  "outputs": [
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     "text/plain": [
      "'f3e12114-24f4-4bae-9d60-2897d27e7ce6'"
     ]
    },
    "execution_count": 59,
    "metadata": {},
    "output_type": "execute_result"
   }
  ],
  "source": [
   "model_id"
  ]
```

```
 },
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  "execution_count": 60,
  "metadata": {},
  "outputs": [
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    "name": "stdout",
    "output_type": "stream",
    "text": [
     "Successfully saved model content to file: 'my_model.tar.gz'\n"
    ]
   },
   {
    "data": {
     "text/plain": [
      "'/home/wsuser/work/my_model.tar.gz'"
     ]
    },
    "execution_count": 60,
    "metadata": {},
    "output_type": "execute_result"
   }
  ],
  "source": [
   "client.repository.download(model_id, 'my_model.tar.gz')"
  ]
 }
],
"metadata": {
 "colab": {
```

```
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  "name": "python3"
 },
 "language_info": {
  "codemirror_mode": {
   "name": "ipython",
   "version": 3
  },
  "file_extension": ".py",
  "mimetype": "text/x-python",
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  "nbconvert_exporter": "python",
  "pygments_lexer": "ipython3",
  "version": "3.9.13"
 }
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"nbformat": 4,
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