PROYECTO CIENCIA DE DATOS - Sistema de Asistencia para Limitados Visuales en la Unab

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DESCRIPCIÓN:

El objetivo es desarrollar una aplicación de ayuda para personas con discapacidad visual en la Universidad (Unab), que permita conocer de forma interactiva el Laboratorio Smart Region Lab. La aplicación capturará imágenes de diferentes áreas, identificará espacios y equipos, y generará información hablada acerca de cada uno. Además, contará con un sistema interactivo basado en una red generativa de voz y texto que responderá preguntas y ofrecerá más detalles a los usuarios.

OBJETIVOS:

Accesibilidad y Orientación:

Permitir que personas con limitaciones visuales puedan conocer los distintos espacios, áreas y equipos del Smart Region Lab mediante descripciones de audio.

Captura y Procesamiento de Imágenes:

Utilizar técnicas de visión por computadora para reconocer y clasificar áreas y equipos a partir de fotografías.

Generación de Información:

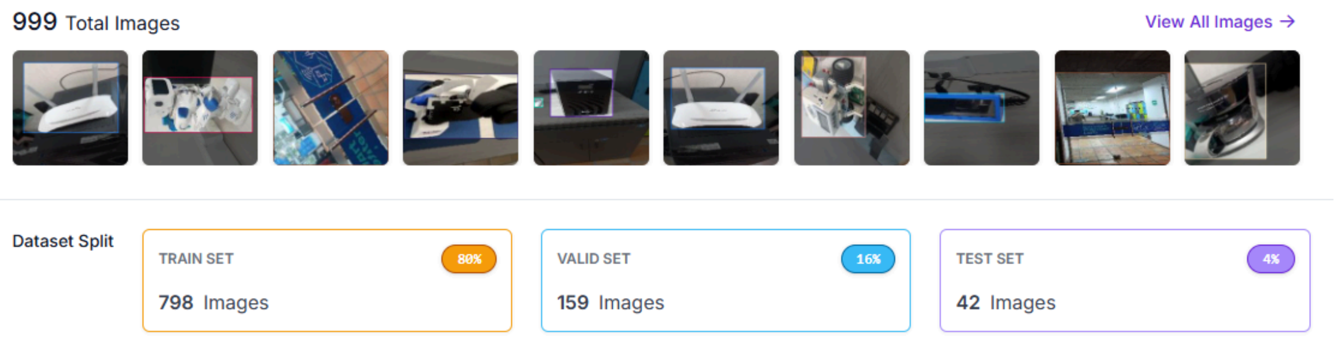
Integrar un sistema de generación de voz y texto (mediante modelos generativos) que no solo describa los espacios, sino que también responda preguntas y amplíe la información según la interacción del usuario.

Interactividad y Respuesta Dinámica:

Ofrecer un sistema interactivo en el que el usuario pueda realizar consultas y recibir respuestas detalladas sobre los equipos, áreas y funciones de cada espacio.

EXPLORACIÓN Y PREPROCESAMIENTO DE LA DATASET

Se tomaron muestras de cada clase, son 20 clases, las cuales se aumentaron, luego se proporcionaron con un tamaño de imagen de (224,224). Posterior a esto se realizó labelImg a partir de bounding boxes mediante la plataforma gratuita de Roboflow, en la cual se asignaron los datos de entrenamiento, de validación y de prueba.



999 Total Images

Dataset Split

TRAIN SET 80%
798 Images

VALID SET 16%
159 Images

TEST SET 4%
42 Images

Importar librerías

```
!pip install ultralytics opencv-python
```

```
Collecting ultralytics
  Downloading ultralytics-8.3.133-py3-none-any.whl.metadata (37 kB)
Requirement already satisfied: opencv-python in /usr/local/lib/python3.11/dist-packages (4.11.0.86)
Requirement already satisfied: numpy>=1.23.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (2.0.2)
Requirement already satisfied: matplotlib>=3.3.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (3.10.0)
Requirement already satisfied: pillow>=7.1.2 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (11.2.1)
Requirement already satisfied: pyyaml>=5.3.1 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (6.0.2)
Requirement already satisfied: requests>=2.23.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (2.32.3)
Requirement already satisfied: scipy>=1.4.1 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (1.15.3)
Requirement already satisfied: torch>=1.8.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (2.6.0+cu124)
Requirement already satisfied: torchvision>=0.9.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (0.21.0+cu124)
Requirement already satisfied: tqdm>=4.64.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (4.67.1)
Requirement already satisfied: psutil in /usr/local/lib/python3.11/dist-packages (from ultralytics) (5.9.5)
Requirement already satisfied: py-cpuinfo in /usr/local/lib/python3.11/dist-packages (from ultralytics) (9.0.0)
Requirement already satisfied: pandas>=1.1.4 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (2.2.2)
Requirement already satisfied: seaborn>=0.11.0 in /usr/local/lib/python3.11/dist-packages (from ultralytics) (0.13.2)
Collecting ultralytics-thop>=2.0.0 (from ultralytics)
  Downloading ultralytics_thop-2.0.14-py3-none-any.whl.metadata (9.4 kB)
Requirement already satisfied: contourpy>=1.0.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (1.3.
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (4.5
Requirement already satisfied: kiwisolver>=1.3.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (1.4
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (24.2)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (3.2.
Requirement already satisfied: python-dateutil>=2.7 in /usr/local/lib/python3.11/dist-packages (from matplotlib>=3.3.0->ultralytics) (
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas>=1.1.4->ultralytics) (2025.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas>=1.1.4->ultralytics) (2025.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics) (2.4
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.11/dist-packages (from requests>=2.23.0->ultralytics) (202
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (3.18.0)
Requirement already satisfied: typing-extensions>=4.10.0 in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (
Requirement already satisfied: networkx in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (3.4.2)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (3.1.6)
Requirement already satisfied: fsspec in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (2025.3.2)
Collecting nvidia-cuda-nvrtc-cu12==12.4.127 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cuda_nvrtc_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-runtime-cu12==12.4.127 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cuda_runtime_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-cupti-cu12==12.4.127 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cuda_cupti_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cudnn-cu12==9.1.0.70 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cudnn_cu12-9.1.0.70-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cublas-cu12==12.4.5.8 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cublas_cu12-12.4.5.8-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cufft-cu12==11.2.1.3 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cufft_cu12-11.2.1.3-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-curand-cu12==10.3.5.147 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_curand_cu12-10.3.5.147-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cusolver-cu12==11.6.1.9 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cusolver_cu12-11.6.1.9-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cusparse-cu12==12.3.1.170 (from torch>=1.8.0->ultralytics)
  Downloading nvidia_cusparse_cu12-12.3.1.170-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Requirement already satisfied: nvidia-cusparselt-cu12==0.6.2 in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytic
Requirement already satisfied: nvidia-nccl-cu12==2.21.5 in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics) (2
Requirement already satisfied: nvidia-nvtx-cu12==12.4.127 in /usr/local/lib/python3.11/dist-packages (from torch>=1.8.0->ultralytics)
```

```
%pip show ultralytics
```

```
Name: ultralytics
Version: 8.3.133
Summary: Ultralytics YOLO 🚀 for SOTA object detection, multi-object tracking, instance segmentation, pose estimation and image classif
Home-page: https://ultralytics.com
Author:
Author-email: Glenn Jocher <glenn.jocher@ultralytics.com>, Jing Qiu <jing.qiu@ultralytics.com>
License: AGPL-3.0
Location: /usr/local/lib/python3.11/dist-packages
Requires: matplotlib, numpy, opencv-python, pandas, pillow, psutil, py-cpuinfo, pyyaml, requests, scipy, seaborn, torch, torchvision, tq
Required-by:
```

```
import torch
import os
import cv2
import shutil
import zipfile
import requests
import random
from ultralytics import YOLO
from IPython.display import Image, clear_output
```

```
Creating new Ultralytics Settings v0.0.6 file ✅
View Ultralytics Settings with 'yolo settings' or at '/root/.config/Ultralytics/settings.json'
Update Settings with 'yolo settings key=value', i.e. 'yolo settings runs_dir=path/to/dir'. For help see https://docs.ultralytics.com/qui
```

Importar la dataset

La dataset se encuentra organizada de la siguiente manera:

```
dataset/
├── train/
│   ├── images/
│   └── labels/
├── valid/
│    ├── images/
│    └── labels/
├── test/
│    ├── images/
│    └── labels/
├── data.yaml
│
├── README.dataset
│
|── README.roboflow
```

```
# Definir rutas base
base_path = "/content"
zip_path = os.path.join(base_path, "LABCD.v2i.yolov8.zip")

def download_zip(url, dest):
    response = requests.get(url, stream=True)
    with open(dest, "wb") as file:
        for chunk in response.iter_content(chunk_size=8192):
            file.write(chunk)
    print("Archivo ZIP descargado correctamente.")

def extract_zip(zip_file, dest_folder):
    dataset_folder = os.path.join(dest_folder, "dataset")  # Extraer en "dataset/"
    os.makedirs(dataset_folder, exist_ok=True)  # Asegurar que la carpeta existe
    with zipfile.ZipFile(zip_file, 'r') as zip_ref:
        zip_ref.extractall(dataset_folder)  # Extraer en dataset/
    print(f"Contenido extraído en {dataset_folder}: {os.listdir(dataset_folder)}")


# Ejecutar procesos
download_zip("https://github.com/Angiela-Vargas/Data-Science-LABCD/blob/main/LABCD.v2i.yolov8.zip?raw=true", zip_path)
extract_zip(zip_path, base_path)
```

```
Archivo ZIP descargado correctamente.
Contenido extraído en /content/dataset: ['data.yaml', 'valid', 'test', 'README.roboflow.txt', 'README.dataset.txt', 'train']
```

Verificar la descarga y extracción

```
labels_val_path = "/content/dataset/valid/labels"  # Ajusta la ruta según tu dataset

if os.path.exists(labels_val_path):
    label_files = [f for f in os.listdir(labels_val_path) if f.endswith(".txt")]
    if len(label_files) == 0:
        print("⚠️ No se encontraron etiquetas en:", labels_val_path)
    else:
        print(f"✅ Se encontraron {len(label_files)} archivos de etiquetas.")
else:
    print("⚠️ La carpeta de etiquetas no existe.")
```

```
✅ Se encontraron 159 archivos de etiquetas.
```

Validar estructura completa del dataset

```
base_path = "/content/dataset"
subdirs = ["train/images", "train/labels", "valid/images", "valid/labels", "test/images", "test/labels"]

for subdir in subdirs:
    full_path = os.path.join(base_path, subdir)
    if not os.path.exists(full_path):
        print(f"🚨 ERROR: No se encontró la carpeta {full_path}")
    else:
        print(f"✅ {full_path} encontrado, contiene {len(os.listdir(full_path))} archivos")
```

```
✅ /content/dataset/train/images encontrado, contiene 798 archivos
✅ /content/dataset/train/labels encontrado, contiene 798 archivos
✅ /content/dataset/valid/images encontrado, contiene 159 archivos
✅ /content/dataset/valid/labels encontrado, contiene 159 archivos
✅ /content/dataset/test/images encontrado, contiene 42 archivos
✅ /content/dataset/test/labels encontrado, contiene 42 archivos
```

Edición del archivo `dataset.yaml`

El archivo `.yaml` define:

- Ruta base de los datos.
- Subcarpetas de entrenamiento, validación y prueba.
- Número de clases (`nc`).
- Nombres de las clases.

\`\`\`yaml

train: ../train/images

val: ../valid/images

test: ../test/images

nc: 21

names: ['Microscopio óptico avanzado', 'Agitador magnético con placa calefactora', 'Aire acondicionado YORK', 'Cafetera', 'Computador', 'Control remoto de robot', 'Control remoto de Smart TV', 'Estación de soldadura por aire caliente', 'Impresora 3D Creality K1 Max', 'Mini fresadora CNC', 'Mouse', 'Objetos (varios)', 'Osciloscopio digital Rigol DS1202ZE', 'Puerta', 'Robot humanoide AULER', 'Robot Lego Mindstorms EV3', 'Router', 'Sensor de suelo integrado', 'Tablet', 'Tomacorrientes 110V', 'UPS Netio']

roboflow: workspace: labcd project: labcd version: 2 license: CC BY 4.0 url: https://universe.roboflow.com/labcd/labcd/dataset/2

Nombres:

0: Microscopio óptico avanzado

1: Agitador magnético con placa calefactora

2: Aire acondicionado YORK

3: Cafetera

4: Computador

5: Control remoto de robot

6: Control remoto de Smart TV

7: Estación de soldadura por aire caliente

8: Impresora 3D Creality K1 Max

9: Mini fresadora CNC

10: Mouse

11: Objetos (varios)

12: Osciloscopio digital Rigol DS1202ZE

13: Puerta

14: Robot humanoide AULER

15: Robot Lego Mindstorms EV3

16: Router

17: Sensor de suelo integrado

18: Tablet

19: Tomacorrientes 110V

20: UPS Netio

Cargar modelo base YOLOv8 y Cargar pesos preentrenados YOLOv8

Se carga el modelo YOLOv8 con pesos base (`yolov8s.pt`), listos para ser ajustados a nuestro conjunto de datos.

```
model = YOLO("yolov8s.pt")
```

```
Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/yolov8s.pt to 'yolov8s.pt'...
100%|██████████| 21.5M/21.5M [00:00<00:00, 95.9MB/s]
```

Entrenamiento del modelo YOLOv8 con la dataset creada en Roboflow

```
model.train(data="/content/dataset/data.yaml", epochs=50, imgsz=640,batch=16)
```

```
Ultralytics 8.3.133 🚀 Python-3.11.12 torch-2.6.0+cu124 CUDA:0 (Tesla T4, 15095MiB)
engine/trainer: agnostic_nms=False, amp=True, augment=False, auto_augment=randaugment, batch=16, bgr=0.0, box=7.5, cache=False, cfg=Nc
Downloading https://ultralytics.com/assets/Arial.ttf to '/root/.config/Ultralytics/Arial.ttf'...
100%|██████████| 755k/755k [00:00<00:00, 20.7MB/s]Overriding model.yaml nc=80 with nc=21

                   from  n    params  module                                       arguments
  0                  -1  1       928  ultralytics.nn.modules.conv.Conv             [3, 32, 3, 2]
  1                  -1  1     18560  ultralytics.nn.modules.conv.Conv             [32, 64, 3, 2]
  2                  -1  1     29056  ultralytics.nn.modules.block.C2f             [64, 64, 1, True]
  3                  -1  1     73984  ultralytics.nn.modules.conv.Conv             [64, 128, 3, 2]
  4                  -1  2    197632  ultralytics.nn.modules.block.C2f             [128, 128, 2, True]
  5                  -1  1    295424  ultralytics.nn.modules.conv.Conv             [128, 256, 3, 2]
  6                  -1  2    788480  ultralytics.nn.modules.block.C2f             [256, 256, 2, True]
  7                  -1  1   1180672  ultralytics.nn.modules.conv.Conv             [256, 512, 3, 2]
  8                  -1  1   1838080  ultralytics.nn.modules.block.C2f             [512, 512, 1, True]
  9                  -1  1    656896  ultralytics.nn.modules.block.SPPF            [512, 512, 5]
 10                  -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']

 11             [-1, 6]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 12                  -1  1    591360  ultralytics.nn.modules.block.C2f             [768, 256, 1]
 13                  -1  1         0  torch.nn.modules.upsampling.Upsample         [None, 2, 'nearest']
 14             [-1, 4]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 15                  -1  1    148224  ultralytics.nn.modules.block.C2f             [384, 128, 1]
 16                  -1  1    147712  ultralytics.nn.modules.conv.Conv             [128, 128, 3, 2]
 17            [-1, 12]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 18                  -1  1    493056  ultralytics.nn.modules.block.C2f             [384, 256, 1]
 19                  -1  1    590336  ultralytics.nn.modules.conv.Conv             [256, 256, 3, 2]
 20             [-1, 9]  1         0  ultralytics.nn.modules.conv.Concat           [1]
 21                  -1  1   1969152  ultralytics.nn.modules.block.C2f             [768, 512, 1]
 22        [15, 18, 21]  1   2124175  ultralytics.nn.modules.head.Detect           [21, [128, 256, 512]]
Model summary: 129 layers, 11,143,727 parameters, 11,143,711 gradients, 28.7 GFLOPs

Transferred 349/355 items from pretrained weights
Freezing layer 'model.22.dfl.conv.weight'
AMP: running Automatic Mixed Precision (AMP) checks...
Downloading https://github.com/ultralytics/assets/releases/download/v8.3.0/yolo11n.pt to 'yolo11n.pt'...
100%|██████████| 5.35M/5.35M [00:00<00:00, 120MB/s]
AMP: checks passed ✅
train: Fast image access ✅ (ping: 0.0±0.0 ms, read: 350.8±108.0 MB/s, size: 9.7 KB)
train: Scanning /content/dataset/train/labels... 798 images, 0 backgrounds, 0 corrupt: 100%|██████████| 798/798 [00:00<00:00, 2430.51i

albumentations: Blur(p=0.01, blur_limit=(3, 7)), MedianBlur(p=0.01, blur_limit=(3, 7)), ToGray(p=0.01, method='weighted_average', num_
val: Fast image access ✅ (ping: 0.0±0.0 ms, read: 247.0±129.8 MB/s, size: 7.9 KB)
val: Scanning /content/dataset/valid/labels... 159 images, 0 backgrounds, 0 corrupt: 100%|██████████| 159/159 [00:00<00:00, 1646.72it/

Plotting labels to runs/detect/train/labels.jpg...
optimizer: 'optimizer=auto' found, ignoring 'lr0=0.01' and 'momentum=0.937' and determining best 'optimizer', 'lr0' and 'momentum' aut
optimizer: AdamW(lr=0.0004, momentum=0.9) with parameter groups 57 weight(decay=0.0), 64 weight(decay=0.0005), 63 bias(decay=0.0)
Image sizes 640 train, 640 val
Using 2 dataloader workers
Logging results to runs/detect/train
Starting training for 50 epochs...

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
       1/50      3.73G      1.054       4.52      1.552         41        640: 100%|██████████| 50/50 [00:17<00:00,  2.89it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████████| 5/5 [00:02<00:00,  1.79it/s
```

```
metrics = model.val()
print(metrics)
```

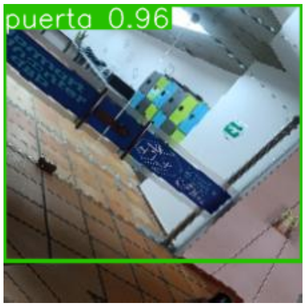
```
Ultralytics 8.3.133 🚀 Python-3.11.12 torch-2.6.0+cu124 CUDA:0 (Tesla T4, 15095MiB)
Model summary (fused): 72 layers, 11,133,711 parameters, 0 gradients, 28.5 GFLOPs
val: Fast image access ✅ (ping: 0.0±0.0 ms, read: 315.1±130.2 MB/s, size: 7.0 KB)
val: Scanning /content/dataset/valid/labels.cache... 159 images, 0 backgrounds, 0 corrupt: 100%|██████████| 159/159 [00:00<?, ?it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100%|██████████| 10/10 [00:03<00:00,  2.58it
                   all        159        194      0.987      0.957      0.982      0.906
advanced_optical_microscope          9          9      0.991          1      0.995       0.89
agitador_magnetico_placa_calentamiento_EQ_AMPC1C          9          9      0.991          1      0.995      0.884
aire_acondicionado_YORK          6          6      0.984          1      0.995       0.96
              cafetera          8          8      0.994          1      0.995      0.949
            computador         10         19      0.944      0.895      0.983      0.827
  control_remoto_robot         11         11      0.988      0.727       0.79      0.732
control_remoto_smart_tv          8          8      0.994          1      0.995      0.918
estacion_soldadura_aire_caliente         10         10      0.992          1      0.995      0.909
impresora_3d_creality_k1_max          8          8          1      0.884      0.995      0.841
    mini_fresadora_cnc          8          8      0.989          1      0.995      0.885
                 mouse          8          8      0.988          1      0.995      0.956
               objects          1          1      0.922          1      0.995      0.995
osciloscopio_digital_ rigol_ds1202ze          7          7          1      0.884      0.995      0.899
                puerta          8          8      0.991          1      0.995      0.828
 robot_humanoide_AULER         14         14          1       0.87      0.935       0.85
robot_lego_mindstorms_ev3          8          8      0.991          1      0.995      0.862
                router          8          8       0.99          1      0.995      0.946
soil_integrated_sensor          8          8      0.988          1      0.995      0.975
                tablet          8          8      0.985          1      0.995      0.981
   tomacorrientes_110V          8         20          1      0.943      0.995      0.957
             ups_netio          8          8          1      0.896      0.995      0.976
Speed: 3.3ms preprocess, 9.8ms inference, 0.0ms loss, 2.9ms postprocess per image
Results saved to runs/detect/train2
ultralytics.utils.metrics.DetMetrics object with attributes:

ap_class_index: array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20])
box: ultralytics.utils.metrics.Metric object
confusion_matrix: <ultralytics.utils.metrics.ConfusionMatrix object at 0x795891970710>
curves: ['Precision-Recall(B)', 'F1-Confidence(B)', 'Precision-Confidence(B)', 'Recall-Confidence(B)']
curves_results: [[array([          0,    0.001001,    0.002002,    0.003003,    0.004004,    0.005005,    0.006006,    0.007007,    0.
          0.024024,    0.025025,    0.026026,    0.027027,    0.028028,    0.029029,     0.03003,    0.031031,    0.032032,    0.03303
          0.048048,    0.049049,     0.05005,    0.051051,    0.052052,    0.053053,    0.054054,    0.055055,    0.056056,    0.05705
          0.072072,    0.073073,    0.074074,    0.075075,    0.076076,    0.077077,    0.078078,    0.079079,     0.08008,    0.08108
          0.096096,    0.097097,    0.098098,    0.099099,      0.1001,      0.1011,      0.1021,      0.1031,      0.1041,     0.1051
           0.12012,     0.12112,     0.12212,     0.12312,     0.12412,     0.12513,     0.12613,     0.12713,     0.12813,     0.1291
           0.14414,     0.14515,     0.14615,     0.14715,     0.14815,     0.14915,     0.15015,     0.15115,     0.15215,     0.1531
           0.16817,     0.16917,     0.17017,     0.17117,     0.17217,     0.17317,     0.17417,     0.17518,     0.17618,     0.1771
           0.19219,     0.19319,     0.19419,      0.1952,      0.1962,      0.1972,      0.1982,      0.1992,      0.2002,      0.201
           0.21622,     0.21722,     0.21822,     0.21922,     0.22022,     0.22122,     0.22222,     0.22322,     0.22422,     0.2252
           0.24024,     0.24124,     0.24224,     0.24324,     0.24424,     0.24525,     0.24625,     0.24725,     0.24825,     0.2492
           0.26426,     0.26527,     0.26627,     0.26727,     0.26827,     0.26927,     0.27027,     0.27127,     0.27227,     0.2732
           0.28829,     0.28929,     0.29029,     0.29129,     0.29229,     0.29329,     0.29429,      0.2953,      0.2963,      0.297
           0.31231,     0.31331,     0.31431,     0.31532,     0.31632,     0.31732,     0.31832,     0.31932,     0.32032,     0.3213
           0.33634,     0.33734,     0.33834,     0.33934,     0.34034,     0.34134,     0.34234,     0.34334,     0.34434,     0.3453
           0.36036,     0.36136,     0.36236,     0.36336,     0.36436,     0.36537,     0.36637,     0.36737,     0.36837,     0.3693
           0.38438,     0.38539,     0.38639,     0.38739,     0.38839,     0.38939,     0.39039,     0.39139,     0.39239,     0.3933
           0.40841,     0.40941,     0.41041,     0.41141,     0.41241,     0.41341,     0.41441,     0.41542,     0.41642,     0.4174
           0.43243,     0.43343,     0.43443,     0.43544,     0.43644,     0.43744,     0.43844,     0.43944,     0.44044,     0.4414
           0.45646,     0.45746,     0.45846,     0.45946,     0.46046,     0.46146,     0.46246,     0.46346,     0.46446,     0.4654
           0.48048,     0.48148,     0.48248,     0.48348,     0.48448,     0.48549,     0.48649,     0.48749,     0.48849,     0.4894
            0.5045,     0.50551,     0.50651,     0.50751,     0.50851,     0.50951,     0.51051,     0.51151,     0.51251,     0.5135
```

Testear el modelo

```
# Cargar la imagen
image_path = "/content/dataset/test/images/augmented_0_jpg.rf.bfdcb4435da150ef47c97b4b1c2ab783.jpg"

image = cv2.imread(image_path)
results = model.predict(image_path, save=True, imgsz=640)

# Guardar la imagen
cv2.imwrite("imagen.jpg", image)
```

```
image 1/1 /content/dataset/test/images/augmented_0_jpg.rf.bfdcb4435da150ef47c97b4b1c2ab783.jpg: 640x640 1 puerta, 16.0ms
Speed: 4.8ms preprocess, 16.0ms inference, 1.8ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train3
True
```

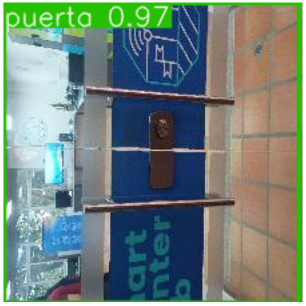
```
results[0].show()
```



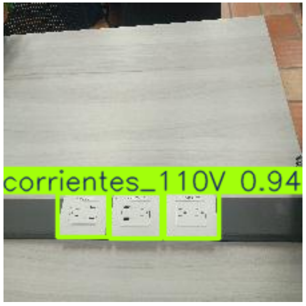
Realizaremos una predicción de todas las imagenes que se encuentran en la carpeta de test

```
#Hagamos la prediccion de todas las images que están en test

# Definir la ruta a la carpeta de imágenes de prueba
test_images_dir = "/content/dataset/test/images"

# Iterar sobre todas las imágenes en la carpeta de prueba
for filename in os.listdir(test_images_dir):
    if filename.endswith(('.jpg', '.jpeg', '.png')):  # Ajusta las extensiones si es necesario
        image_path = os.path.join(test_images_dir, filename)
        results = model.predict(image_path, save=True, imgsz=640)  # Realizar la predicción
        print(f"Predicción realizada para: {filename}")
        # Puedes acceder a las predicciones a través de results[0].boxes, results[0].probs, etc.
        # Si deseas visualizar las imágenes con las predicciones:
        results[0].show()
```

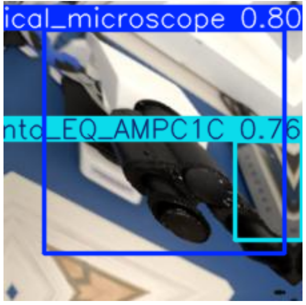
```
image 1/1 /content/dataset/test/images/original_15_jpg.rf.acb378137bded5d264a582f7e5458adb.jpg: 640x640 1 puerta, 16.0ms
Speed: 2.7ms preprocess, 16.0ms inference, 1.7ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train4
Predicción realizada para: original_15_jpg.rf.acb378137bded5d264a582f7e5458adb.jpg
```



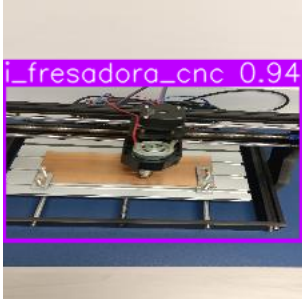
```
image 1/1 /content/dataset/test/images/original_4_jpg.rf.e09549b155ad6a60c032e23436495d22.jpg: 640x640 3 tomacorrientes_110Vs, 16.0ms
Speed: 3.5ms preprocess, 16.0ms inference, 1.7ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train5
Predicción realizada para: original_4_jpg.rf.e09549b155ad6a60c032e23436495d22.jpg
```



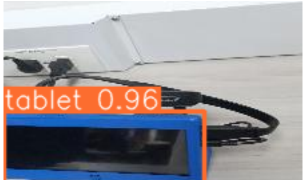
```
image 1/1 /content/dataset/test/images/augmented_21_jpg.rf.f36c7adf607650bca9f3a9842fc56337.jpg: 640x640 1 advanced_optical_microscope,
Speed: 5.0ms preprocess, 16.0ms inference, 1.8ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train6
Predicción realizada para: augmented_21_jpg.rf.f36c7adf607650bca9f3a9842fc56337.jpg
```



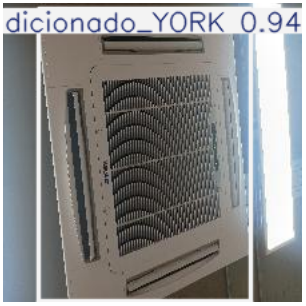
```
image 1/1 /content/dataset/test/images/original_27_jpg.rf.61885bf47ed65ba4e7840b289cc7aab0.jpg: 640x640 1 mini_fresadora_cnc, 16.0ms
Speed: 4.7ms preprocess, 16.0ms inference, 2.0ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train7
Predicción realizada para: original_27_jpg.rf.61885bf47ed65ba4e7840b289cc7aab0.jpg
```



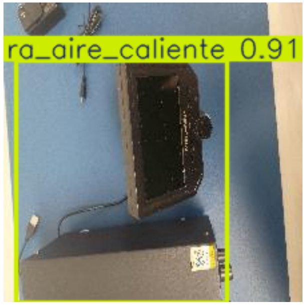
```
image 1/1 /content/dataset/test/images/original_5_jpg.rf.f0dbdc2b69ee008d6ed8f30a5a5efe62.jpg: 640x640 1 tablet, 16.0ms
Speed: 4.1ms preprocess, 16.0ms inference, 2.0ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train8
Predicción realizada para: original_5_jpg.rf.f0dbdc2b69ee008d6ed8f30a5a5efe62.jpg
```



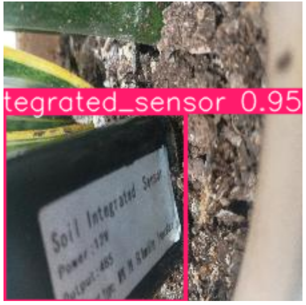
```
image 1/1 /content/dataset/test/images/original_22_jpg.rf.26d8c2b9f4f761749f26624f179c4b86.jpg: 640x640 1 aire_acondicionado_YORK, 15.7m
Speed: 3.7ms preprocess, 15.7ms inference, 1.9ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train9
Predicción realizada para: original_22_jpg.rf.26d8c2b9f4f761749f26624f179c4b86.jpg
```



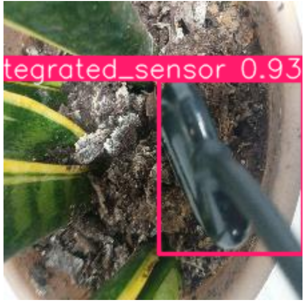
```
image 1/1 /content/dataset/test/images/original_12_jpg.rf.90a8cac4ca5a41bdf47e7869ee2556b3.jpg: 640x640 1 estacion_soldadura_aire_calien
Speed: 3.6ms preprocess, 15.7ms inference, 1.8ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train10
Predicción realizada para: original_12_jpg.rf.90a8cac4ca5a41bdf47e7869ee2556b3.jpg
```



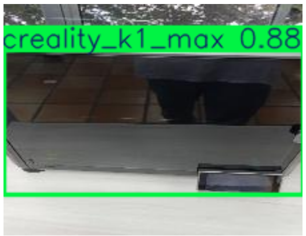
```
image 1/1 /content/dataset/test/images/original_9_jpg.rf.252e00adb381960466ba9339f30a8a16.jpg: 640x640 1 soil_integrated_sensor, 15.4ms
Speed: 3.4ms preprocess, 15.4ms inference, 2.0ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train11
Predicción realizada para: original_9_jpg.rf.252e00adb381960466ba9339f30a8a16.jpg
```



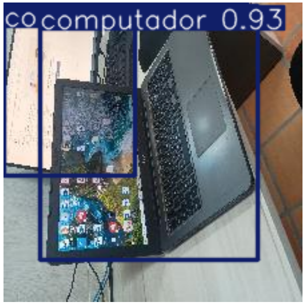
```
image 1/1 /content/dataset/test/images/original_8_jpg.rf.0f3fc8cce4e1b4eddec95b1b3c2419d6.jpg: 640x640 1 soil_integrated_sensor, 15.4ms
Speed: 3.8ms preprocess, 15.4ms inference, 1.8ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train12
Predicción realizada para: original_8_jpg.rf.0f3fc8cce4e1b4eddec95b1b3c2419d6.jpg
```



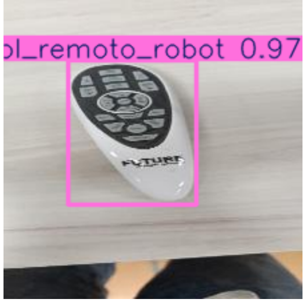
```
image 1/1 /content/dataset/test/images/original_4_jpg.rf.5944ee2318677ec8148813d88ecfb71f.jpg: 640x640 1 impresora_3d_creality_k1_max, 1
Speed: 3.7ms preprocess, 15.4ms inference, 2.4ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train13
Predicción realizada para: original_4_jpg.rf.5944ee2318677ec8148813d88ecfb71f.jpg
```



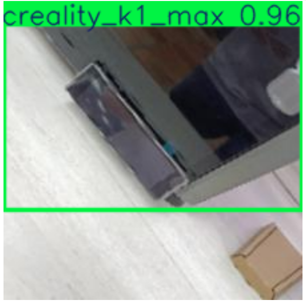
```
image 1/1 /content/dataset/test/images/original_12_jpg.rf.41011768ee60b69e3c8a3343fbe03ed9.jpg: 640x640 2 computadors, 15.5ms
Speed: 3.5ms preprocess, 15.5ms inference, 1.9ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train14
Predicción realizada para: original_12_jpg.rf.41011768ee60b69e3c8a3343fbe03ed9.jpg
```



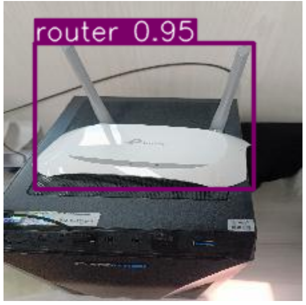
```
image 1/1 /content/dataset/test/images/original_25_jpg.rf.f2c1b329cf9e893f5f105fe692c32485.jpg: 640x640 1 control_remoto_robot, 15.4ms
Speed: 3.4ms preprocess, 15.4ms inference, 1.8ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train15
Predicción realizada para: original_25_jpg.rf.f2c1b329cf9e893f5f105fe692c32485.jpg
```



```
image 1/1 /content/dataset/test/images/augmented_23_jpg.rf.5947bc3c7fd153c9b407187fa0628f9c.jpg: 640x640 1 impresora_3d_creality_k1_max,
Speed: 3.1ms preprocess, 18.3ms inference, 1.8ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train16
Predicción realizada para: augmented_23_jpg.rf.5947bc3c7fd153c9b407187fa0628f9c.jpg
```



```
image 1/1 /content/dataset/test/images/original_19_jpg.rf.0e1ac3dc2949887e8fb82ba16d75935e.jpg: 640x640 1 router, 15.4ms
Speed: 3.5ms preprocess, 15.4ms inference, 1.9ms postprocess per image at shape (1, 3, 640, 640)
Results saved to runs/detect/train17
Predicción realizada para: original_19_jpg.rf.0e1ac3dc2949887e8fb82ba16d75935e.jpg
```



```
image 1/1 /content/dataset/test/images/original_16_jpg.rf.1e719bdba9a24619a7508f67b5745c68.jpg: 640x640 1 robot_humanoide_AULER, 1 tomac
Speed: 3.5ms preprocess, 15.4ms inference, 1.8ms postprocess per image at shape (1, 3, 640, 640)
```