yolov8n object detection

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What is yolo?

Routine Experiment Effect

In this section, we will learn how to use K230 to implement target detection based on yolov8

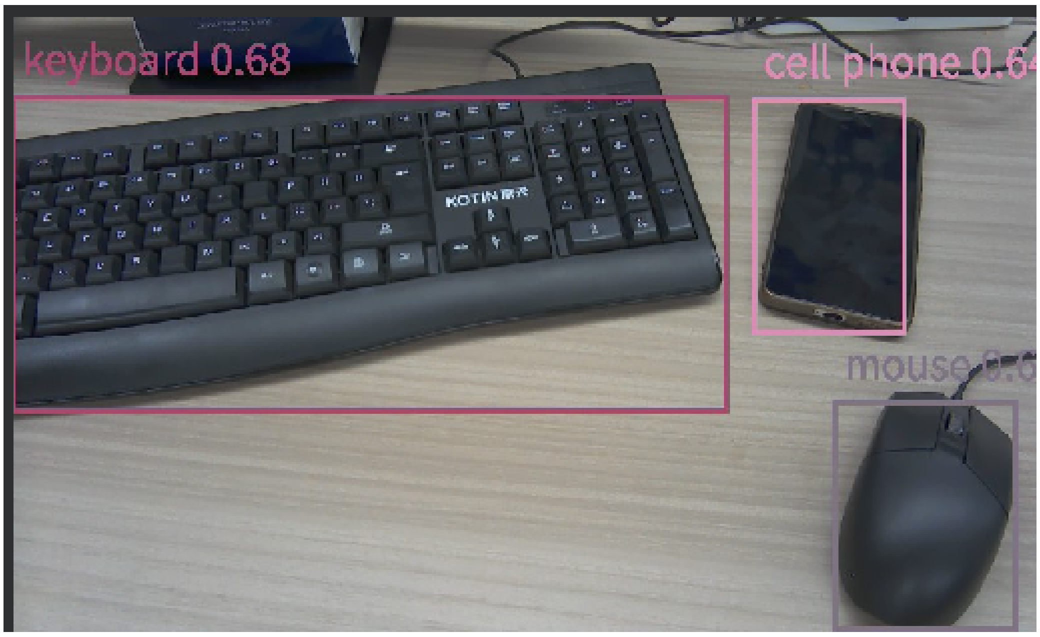
The model we use in this section supports the recognition of nearly 80 types of objects. For specific types of objects that can be recognized, we can refer to the content of the labels array in the code.

A simple summary of the following contents

```
交通工具/Transportation：
自行车/bicycle, 汽车/car, 摩托车/motorcycle, 飞机/airplane, 公共汽车/bus, 火车/train,
卡车/truck, 船/boat

交通设施/Traffic Facilities：
交通信号灯/traffic light, 消防栓/fire hydrant, 停车标志/stop sign, 停车计时器/parking
meter

动物/Animals：
鸟/bird, 猫/cat, 狗/dog, 马/horse, 羊/sheep, 牛/cow, 大象/elephant, 熊/bear, 斑
马/zebra, 长颈鹿/giraffe

个人物品/Personal Items：
背包/backpack, 雨伞/umbrella, 手提包/handbag, 领带/tie, 行李箱/suitcase

运动用品/Sports Equipment：
飞盘/frisbee, 滑雪板/skis, 单板滑雪/snowboard, 运动球/sports ball, 风筝/kite, 棒球
棒/baseball bat, 棒球手套/baseball glove, 滑板/skateboard, 冲浪板/surfboard, 网球
拍/tennis racket

餐饮用品/Dining Items：
瓶子/bottle, 酒杯/wine glass, 杯子/cup, 叉子/fork, 刀/knife, 勺子/spoon, 碗/bowl

食物/Food：
香蕉/banana, 苹果/apple, 三明治/sandwich, 橙子/orange, 西兰花/broccoli, 胡萝卜/carrot,
热狗/hot dog, 披萨/pizza, 甜甜圈/donut, 蛋糕/cake

家居用品/Home Items：
长凳/bench, 椅子/chair, 沙发/couch, 盆栽/potted plant, 床/bed, 餐桌/dining table, 马
桶/toilet, 花瓶/vase
```

```
电子设备/Electronics：
电视/tv，笔记本电脑/laptop，鼠标/mouse，遥控器/remote，键盘/keyboard，手机/cell phone，
微波炉/microwave，烤箱/oven，烤面包机/toaster，水槽/sink，冰箱/refrigerator，吹风
机/hair drier

其他/Others：
书/book，时钟/clock，剪刀/scissors，泰迪熊/teddy bear，牙刷/toothbrush
```

After connecting to the IDE, run the sample code in this section, and then we will find a few simple scenarios to experiment with



You can see that K230 can correctly identify our items and give them scores.

This model can recognize a lot of things, I won't list them all here, you can try it yourself according to the table I listed above

> The current routine has added serial port output
>
> For the protocol format, please refer to [Routine Communication Protocol.xlsx] in the document.

Code Explanation

Code structure

1. Initialization Phase:
    - Load YOLOv8 model
    - Load labels
    - Set parameters
    - Initialize AI2D
    - Generate class colors
2. Preprocessing Flow:
    - Configure preprocessing
    - Calculate padding
    - Resize image
    - Normalize

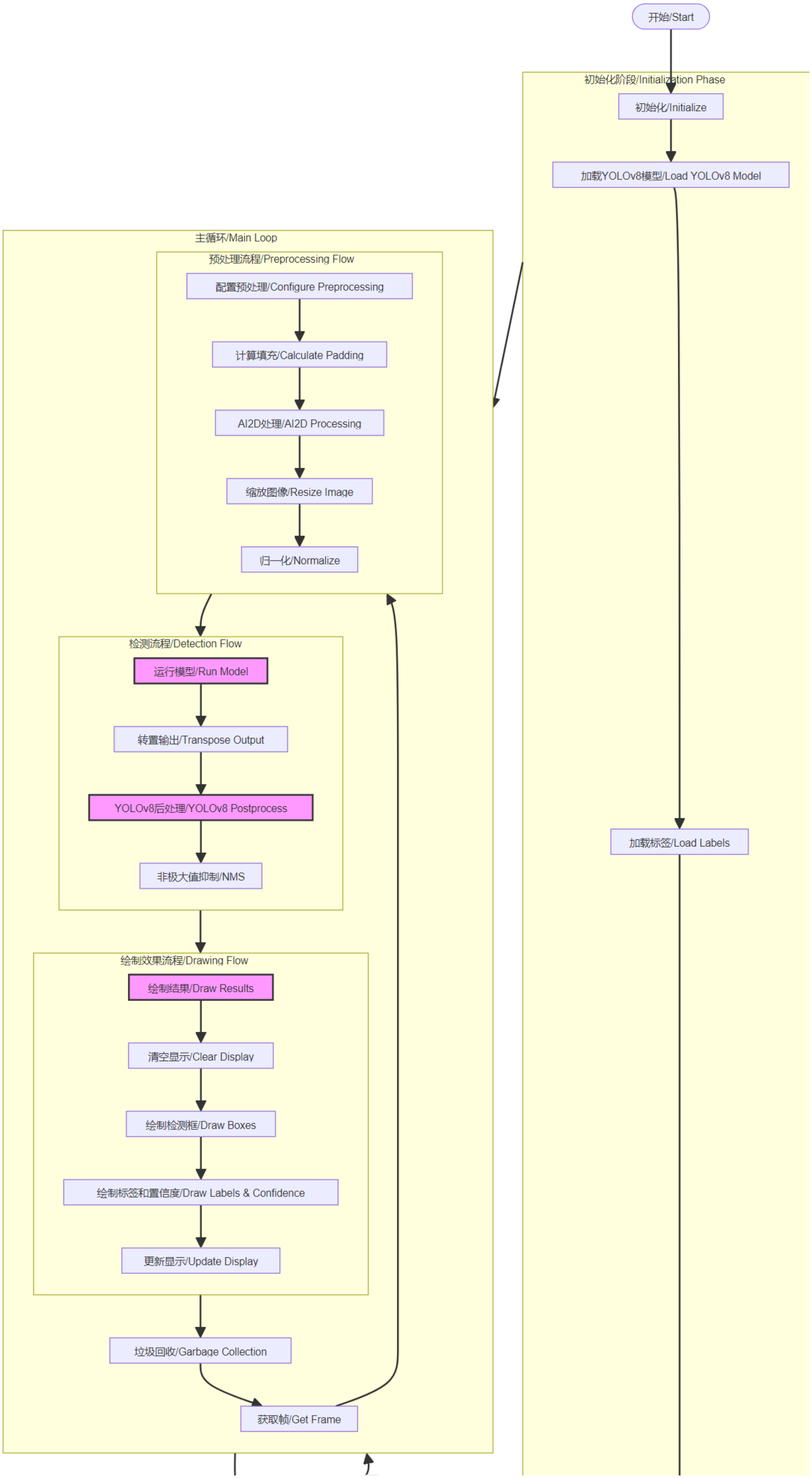
3. Detection Flow:
    - Run model
    - Transpose output
    - Postprocess
    - Non-maximum suppression/NMS
4. Drawing Flow:
    - Clear display
    - Draw boxes
    - Draw labels
    - Update display
5. Main Loop:
    - Get frame
    - Process flow
    - Garbage collection
6. Exit Flow:
    - Exit demo
    - Clean up

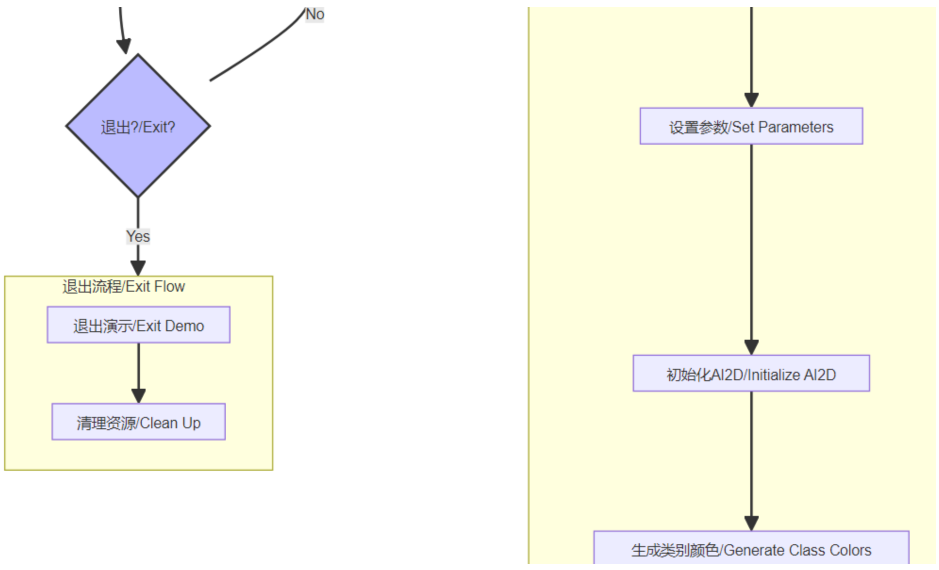
Code Analysis

For the complete code, please refer to the file [Source Code/09.Scene/06.licence_det.py]

```
# 自定义YOLOv8检测类 Custom YOLOv8 detection class
class ObjectDetectionApp(AIBase):
    def
__init__(self,kmodel_path,labels,model_input_size,max_boxes_num,confidence_thres
hold=0.5,nms_threshold=0.2,rgb888p_size=[224,224],display_size=
[1920,1080],debug_mode=0):
        """
        初始化函数 Initialization function
        kmodel_path: 模型路径 Model path
        labels: 标签列表 Label list
        model_input_size: 模型输入大小 Model input size
        max_boxes_num: 最大检测框数量 Maximum number of detection boxes
        confidence_threshold: 置信度阈值 Confidence threshold
        nms_threshold: 非极大值抑制阈值 Non-maximum suppression threshold
        rgb888p_size: RGB图像大小 RGB image size
        display_size: 显示大小 Display size
        debug_mode: 调试模式 Debug mode
        """
        super().__init__(kmodel_path,model_input_size,rgb888p_size,debug_mode)
        self.kmodel_path = kmodel_path
        self.labels = labels
        # 模型输入分辨率 Model input resolution
        self.model_input_size = model_input_size
        # 阈值设置 Threshold settings
        self.confidence_threshold = confidence_threshold
        self.nms_threshold = nms_threshold
        self.max_boxes_num = max_boxes_num
        # sensor给到AI的图像分辨率 Image resolution from sensor to AI
        self.rgb888p_size = [ALIGN_UP(rgb888p_size[0],16),rgb888p_size[1]]
        # 显示分辨率 Display resolution
        self.display_size = [ALIGN_UP(display_size[0],16),display_size[1]]
        self.debug_mode = debug_mode
        # 检测框预置颜色值 Preset colors for detection boxes
        self.color_four = get_colors(len(self.labels))
        # 宽高缩放比例 Width and height scaling ratios
        self.x_factor = float(self.rgb888p_size[0])/self.model_input_size[0]
        self.y_factor = float(self.rgb888p_size[1])/self.model_input_size[1]
        # Ai2d实例，用于实现模型预处理 Ai2d instance for model preprocessing
        self.ai2d = Ai2d(debug_mode)
        # 设置Ai2d的输入输出格式和类型 Set Ai2d input/output format and type

 self.ai2d.set_ai2d_dtype(nn.ai2d_format.NCHW_FMT,nn.ai2d_format.NCHW_FMT,np.uin
t8, np.uint8)

    # 配置预处理操作 Configure preprocessing operations
    def config_preprocess(self,input_image_size=None):
        """
        配置图像预处理参数 Configure image preprocessing parameters
        input_image_size: 输入图像大小(可选) Input image size (optional)
        """
        with ScopedTiming("set preprocess config",self.debug_mode > 0):
            # 初始化ai2d预处理配置 Initialize ai2d preprocessing configuration
            ai2d_input_size = input_image_size if input_image_size else
self.rgb888p_size
            top,bottom,left,right,self.scale =
letterbox_pad_param(self.rgb888p_size,self.model_input_size)
            # 配置padding预处理 Configure padding preprocessing
            self.ai2d.pad([0,0,0,0,top,bottom,left,right], 0, [128,128,128])
            self.ai2d.resize(nn.interp_method.tf_bilinear,
nn.interp_mode.half_pixel)
            self.ai2d.build([1,3,ai2d_input_size[1],ai2d_input_size[0]],
[1,3,self.model_input_size[1],self.model_input_size[0]])

    # 预处理函数 Preprocessing function
    def preprocess(self,input_np):
        with ScopedTiming("preprocess",self.debug_mode > 0):
            return [nn.from_numpy(input_np)]

    # 后处理函数 Postprocessing function
    def postprocess(self,results):
        """
        处理模型输出结果 Process model output results
        results: 模型输出 Model output
        """
        with ScopedTiming("postprocess",self.debug_mode > 0):
            new_result = results[0][0].transpose()
            det_res = aidemo.yolov8_det_postprocess(new_result.copy(),
                [self.rgb888p_size[1],self.rgb888p_size[0]],
                [self.model_input_size[1],self.model_input_size[0]],
                [self.display_size[1],self.display_size[0]],
                len(self.labels),
                self.confidence_threshold,
                self.nms_threshold,
                self.max_boxes_num)
            return det_res

    # 绘制结果函数 Draw results function
    def draw_result(self,pl,dets):
        """
        绘制检测结果 Draw detection results
        pl: PipeLine实例 PipeLine instance
        dets: 检测结果 Detection results
        """
        with ScopedTiming("display_draw",self.debug_mode >0):
            if dets:
                pl.osd_img.clear()
                for i in range(len(dets[0])):
                    x, y, w, h = map(lambda x: int(round(x, 0)), dets[0][i])
                    # 绘制矩形框和标签 Draw rectangle box and label
                    pl.osd_img.draw_rectangle(x,y, w, h,
color=self.color_four[dets[1][i]],thickness=4)
                    pl.osd_img.draw_string_advanced( x , y-50,32,
                        " " + self.labels[dets[1][i]] + " " + str(round(dets[2]
[i],2)) ,
                        color=self.color_four[dets[1][i]])
            else:
                pl.osd_img.clear()
```

The flow chart is as follows:


开始/Start
初始化阶段/Initialization Phase
初始化/Initialize
加载YOLOv8模型/Load YOLOv8 Model
加载标签/Load Labels
主循环/Main Loop
预处理流程/Preprocessing Flow
配置预处理/Configure Preprocessing
计算填充/Calculate Padding
AI2D处理/AI2D Processing
缩放图像/Resize Image
归一化/Normalize
检测流程/Detection Flow
运行模型/Run Model
转置输出/Transpose Output
YOLOv8后处理/YOLOv8 Postprocess
非极大值抑制/NMS
绘制效果流程/Drawing Flow
绘制结果/Draw Results
清空显示/Clear Display
绘制检测框/Draw Boxes
绘制标签和置信度/Draw Labels & Confidence
更新显示/Update Display
垃圾回收/Garbage Collection
获取帧/Get Frame



Algorithm Overview

What is yolo?

YOLO (You Only Look Once) is a popular family of object detection algorithms. Here are the main features:

YOLO basic principle:

- Divide the image into a grid
- Directly predict bounding boxes and class probabilities
- Single-stage detection, fast speed

YOLOv8n features (n means nano, the smallest version):

- Faster inference speed
- Smaller model size (~3MB)
- Using C2f module and SPPF structure
- Suitable for mobile device deployment

Main performance comparison: YOLOv8n on COCO dataset:

- AP: 37.3%
- Speed: About 30% faster than v5
- Parameter volume: 3.2M