1. Preprocess and make additional dataset.

I think that the dataset we have is small for finding tic-tac-toe objects. So I created 11 more images of the game. (All images are in a folder data-> images). Since i decided to use yolo model i need to markup the data. For Train dataset i marked the class labels, the center coordinates and the bounding box sizes. Class 0 is crosses, Class 1 is noughts.

Зображення, що містить Дитяча творчість, ряд, почерк, малюнок

Автоматично згенерований опис

0 0.467344 0.476983 0.074844 0.109499

0 0.485781 0.242056 0.071250 0.115846

0 0.332512 0.268220 0.078414 0.114311

0 0.624160 0.471409 0.070086 0.101587

1 0.312309 0.680141 0.085539 0.182537

1 0.643762 0.246013 0.123555 0.133340

1 0.454277 0.711096 0.084352 0.158727

1 0.664543 0.739666 0.179398 0.212693

1. Model

To solve the problem, I decided to use a pre-trained YOLOv8n model, which I trained on Tic-tac-toe images (19) 10 original, 9 new. I made the following model training settings:

* 100 epochs
* Batch size 4
* Image size 400 (a larger size is not required to recognize these objects)
* Disable mosaic augmentation

For validation and predict.

* intersection over union 0.1 (this game has a grid, so the objects should not overlap much)
* object confidence threshold 0.5

Validation dataset included 2 original, 2 new. After re-training model got this result:

Зображення, що містить текст, знімок екрана, дизайн

Автоматично згенерований опис

Manual labeled

Зображення, що містить текст, знімок екрана, Мультимедійне програмне забезпечення, Графічний редактор

Автоматично згенерований опис

Predicted labels

1. Algorithmic part.

In this part, I algorithmically determined the position of noughts and crosses on the game grid. For this purpose, I use the information about the coordinates of the centers and the sizes of the bounding boxes. After receiving the field with the marks and the coordinates of the centers, I determined the winner and drew the winning line. (Folder out\_imgs)

Зображення, що містить почерк, малюнок, ряд, Дитяча творчість

Автоматично згенерований опис