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AI-based evaluation of the SDGs: the case of crop detection with earth observation data

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Problem Statement

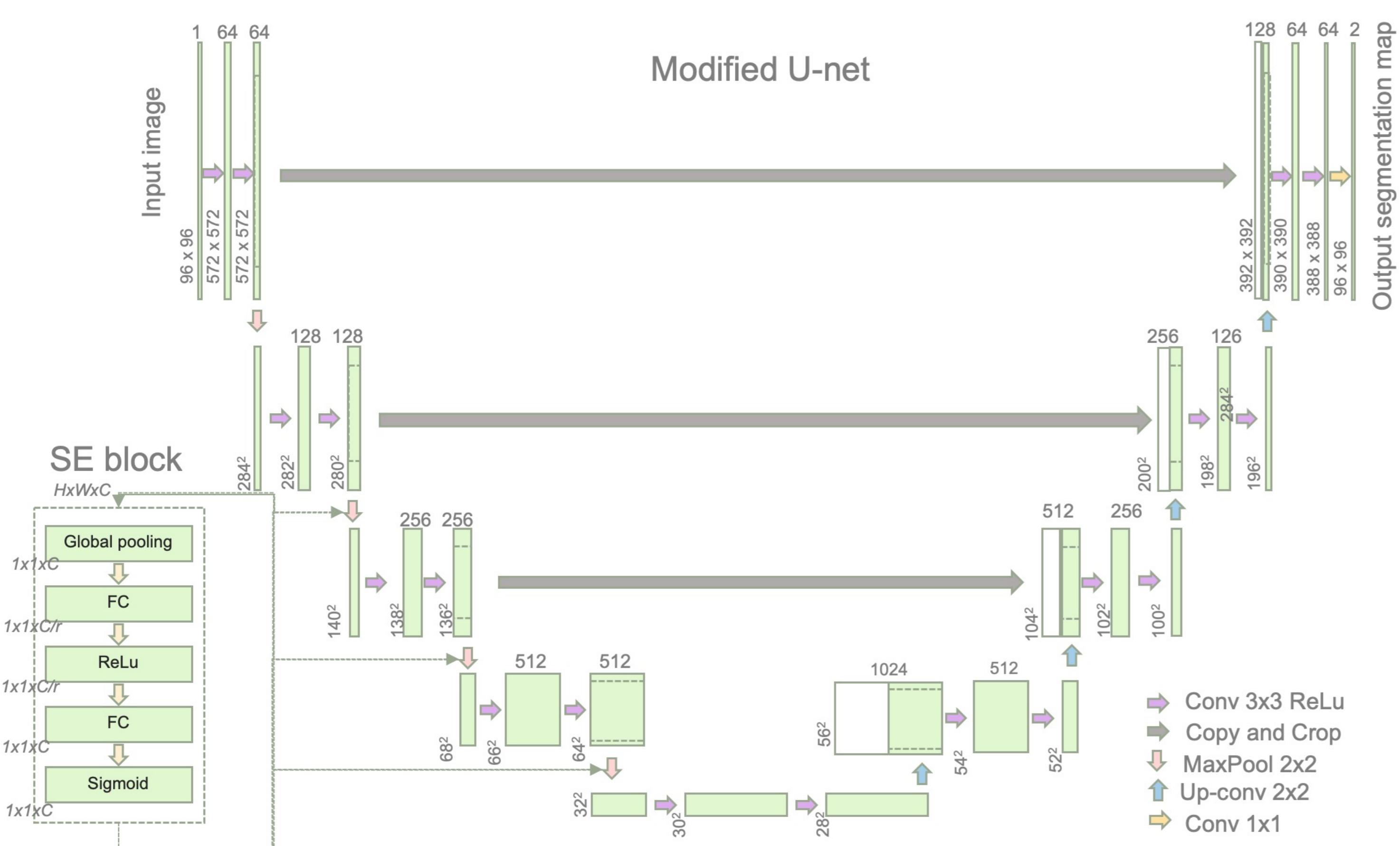
Problem: The framework of the seventeen sustainable development goals is a challenge for developers and researchers applying AI.

Solution: AI and earth observations (EO) can provide reliable and disaggregated data for better monitoring of the sustainable development goals (SDGs). We present an overview of SDG targets, which can be effectively measured with AI tools. We identify indicators with the most significant contribution from the AI and EO (Tier 2 and 3) and describe an application of state-of-the-art ML to one of the indicators.

Model: We describe an application of U-net with SE blocks for efficient segmentation of satellite imagery for crop detection.

Results: We demonstrate how AI can be more effectively applied in solutions directly contributing towards specific SDGs and propose further research on an AI-based evaluative infrastructure for SDGs.

Model Architecture



Architecture: Green boxes correspond to multi-channel feature maps. Different operations are denoted with coloured arrows. The structure of SE blocks is depicted in the bottom-left corner of the figure (all SE blocks share the same structure). The places where the SE blocks are inserted in the model are depicted with the dotted arrows.

Segmentation



Input/Output: Segmentation results on the training set: (a) input image; (b) generated segmentation mask (white: predicted polygons, black: background).

Results



Results: Predicted segmentation of vineyards overlayed with input image.

Prediction accuracy

ARCH	IS	N	MF	DICE
Unet96X2048X4	96	4	2048	0.81
Unet96X1024X4	96	4	1024	0.73
Unet96X512X4	96	4	512	0.61
Unet96X256X4	96	4	256	0.32
Unet192X1024X5	192	5	1024	0.54
Unet96X1024X5	96	5	1024	0.66
Unet48X1024X4	48	4	1024	0.31
Unet96X1024X4-SE	96	4	1024	0.75
Unet96X512X4-SE	96	4	512	0.65
Unet96X256X4-SE	96	4	256	0.35

IS: Input Size

N: Number of downsample/upsample stages

MF: Max filters on lower block

DICE: Measure of overlap

- Trained only with 400 images.

- Accuracy on test set 89%.

Conclusions

The proposed model can be used to evaluate **indicator 2.4.1 "Proportion of agricultural area under productive and sustainable agriculture"**. This task could be decomposed into several sub-tasks: segmentation of satellite imagery to detect crops, which are currently growing in the region; detection of potentially more efficient crops in terms of scarce resource consumption; estimation of the amount of nutrients in the soil; detection of soil moisture and salinity and crop yield prediction. The focus of this research is on the segmentation sub-task.

References

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