AGRI-DRONE AI

Engineering Methods 2025/2026

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Introduction

The project focuses on the development of a drone-based system for agricultural monitoring using artificial intelligence.

Agenda

Overview

- Drones collect aerial data on crops which gets sent to the server and analyzed by an AI algorithm
- Decets pests, diseases, nutrient deficiencies, and irrigation needs.
- Provides actionable recommendations to farmers.

Goals

- Optimize precision agriculture in the Slovak Republic.
- Increase crop yields by 15–25%.
- Reduce pesticide use and promote sustainable farming practices.

System Architecture

- Drone platform : DJI Agriculture, PrecisionHawk, and other modern UAVs.
- Real-time image recognition and predictive analytics AI system.
- Combines multispectral drone imaging, weather data, and satellite imagery.
- Onboard AI for fast field-level analysis.

Comparison of AI Models for Image Analysis

AI Model	Accuracy	Speed	Use Case	Requirements
CNN	High	Medium	Disease Detection	High (GPU)
YOLO	Very High	Fast	Real-time Pest Detection	Moderate (GPU/CPU)
Mask R-CNN	High	Slow	Object Segmentation,	High (GPU)
ResNet	Very High	Slow	Deep Image Recognition	High (GPU)

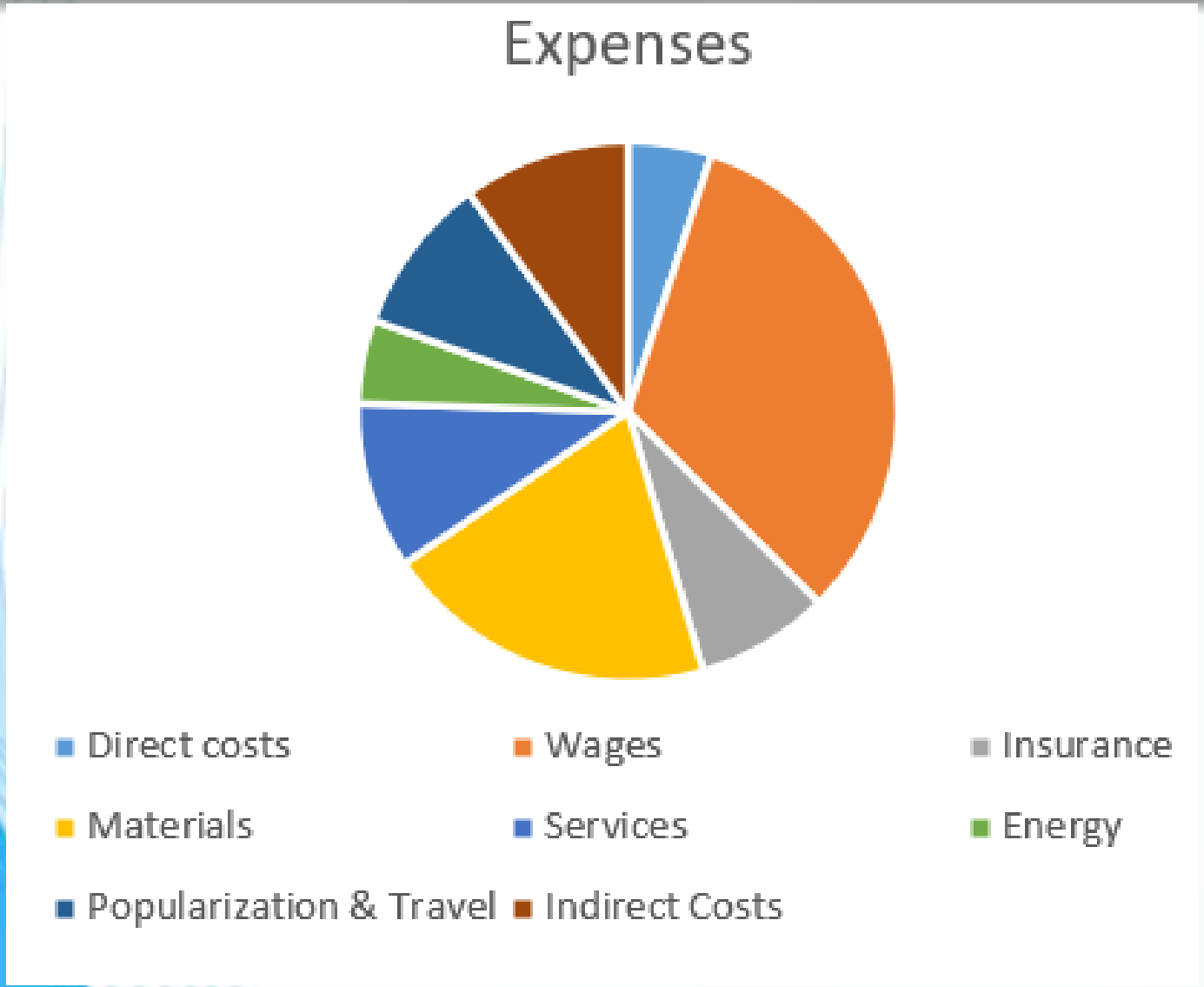
Table: Comparison of Popular AI Models for Image Analysis

References: LeCun et al. (2015) [3], Redmon et al. (2016) [4], He et al. (2017) [1], He et al. (2016) [2].

Development Phases

- 1) Analysis of existing drone technologies and AI frameworks.
- 2) Development of AI models for image recognition and predictive analytics.
- 3) Field testing and performance measurement.

Budget


Expenses
Direct costs
Wages
Insurance
Materials
Services
Energy
Popularization & Travel
Indirect Costs

Market and Impact

- Growing EU agricultural drone market projected to reach €7.46 billion by 2025[5].
- 20% expected increase in efficiency through precision monitoring.
- Economic savings for farmers and environmental protection through reduced chemical use. [3]
- Strengthens Slovakia's position in agricultural innovation.

Comparison and Limitations

- Compared to satellite monitoring: Drones offer higher resolution and real-time data, but cover smaller areas.
- Compared to manual inspection: Faster and more consistent, but requires technical setup and maintenance.
- Limitations:
  - Weather-dependent — drones can't fly in heavy rain or strong wind.
  - Battery life limits flight time and coverage.
  - Initial cost of equipment and training.
  - AI accuracy depends on quality and diversity of training data.

Sources

[1] Kaiming He, Georgia Gkioxari, Piotr Dollar, and Ross Girshick. Mask r-cnn. In IEEE ICCV 2017, pages 2960–2968, 2017.

[2] Kaiming He, Xiangyu Zhang, Shaoqing Ren, and Jian Sun. Deep residual learning for image recognition. In IEEE CVPR 2016, pages 770–778, 2016.

[3] Yann LeCun, Yoshua Bengio, and Geoffrey Hinton. Deep learning. Nature, 521(7553):436–444, 2015.

[4] Joseph Redmon, Santosh Divvala, Ross Girshick, and Ali Farhadi. You only look once: Unified, real-time object detection. In IEEE CVPR 2016, pages 779–788, 2016.

[5] Grand View Research. Agriculture drones market size, share & growth report 2030. `https://www.grandviewresearch.com/industry-analysis/agriculture-drones-market5`, 2025.