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THE IMPORTANCE OF MACHINE LEARNING IN SUSTAINABLE AGRICULTURE

Abstract. In recent years, the field of agriculture has undergone significant changes due to the use of artificial intelligence (AI) and machine learning. These technologies have transformed various aspects of the agricultural sector, including the introduction of automated machinery and the introduction of precision agriculture. In crop production, various machine learning models are used for crop improvement, production optimization, disease and pest prevention, irrigation optimization, fertilizer management, etc. In this research is given example of a simple model based on the scikit-learn library to predict yields based on weather data and other inputs.

Keywords: machine learning, model, algorithm, sustainable agriculture.

Analysis of recent research and publications. Many scientists around the world are researching artificial intelligence and machine learning. Research by foreign scientists, in particular, Dilli Paudel, Allard de Wit, Hendrik Boogaard, Diego Marcos, Sjoukje Osinga, Ioannis N.O [1], and others, is devoted to the application of machine learning tools in agriculture. However, despite significant scientific achievements, significant changes in external economic conditions under the influence of military operations actualize the need for further research into machine learning issues in sustainable agriculture. The purpose of the publication is to justify the advantages of using machine learning methods in agriculture with the aim of increasing productivity, optimizing the use of resources, reducing the impact on the environment and ensuring the sustainable development of agriculture. The paper will consider the application of machine learning algorithms for crop forecasting.

Results and discussion. The role of machine learning in sustainable agriculture is becoming increasingly important as the world grapples with the challenges of feeding a growing population while minimizing the environmental impact of agricultural practices. The application of artificial intelligence (AI) and machine learning (ML) in agriculture is becoming increasingly relevant and useful due to the opportunities that these technologies offer.

Machine learning is a subset of artificial intelligence that involves developing algorithms that can learn and make predictions or decisions based on data. This technology has the potential to revolutionize agriculture by providing farmers with valuable insights and recommendations based on the analysis of vast amounts of data. By using machine learning tools, farmers can make more informed management decisions that will improve efficiency, productivity and sustainability.

It is worth noting that one of the main ways in which machine learning can contribute to sustainable agriculture is through precision farming. This approach involves using data-driven technologies to more accurately and efficiently monitor and manage agricultural operations. For example, machine learning algorithms can analyze data from various sources, such as satellite images, weather forecasts and soil sensors, to provide farmers with real-time information about the condition of their crops and fields. This information can then be used to optimize irrigation, fertilization and pest control practices, ensuring more efficient use of resources and reducing the environmental impact of agriculture [2-4].

Machine learning can also play a critical role in early detection and control of pests and diseases that are a major threat to agricultural productivity and sustainability. By analyzing data from various sources, such as remote sensing and field observations, machine learning algorithms can identify patterns and trends that may indicate the presence of pests or diseases.

Another promising application of machine learning in sustainable agriculture is yield forecasting. Accurate yield forecasts are important for farmers to plan their operations and make informed decisions. Machine learning algorithms can analyze historical data such as past crop yields, weather and soil conditions to predict future yields with greater accuracy than traditional methods. This can help farmers better allocate resources, reduce waste and minimize the risk of crop failure.

One of the key advantages of using machine learning in crop forecasting is its ability to adapt and improve over time. With additional data, algorithms can continuously learn and improve their predictions. This iterative process leads to increasingly accurate predictions, helping farmers make informed decisions about planting, harvesting and resource allocation.

Below is an example of a simple model based on the scikit-learn library to predict yields based on weather data and other inputs.

```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_squared_error
# Loading data
data = pd.read_csv("file.csv")
# Selection of features and target variable
X = data.drop(columns=["yield"])
y = data["yield"]
# Division into training and test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
# Creating a model
model = RandomForestRegressor(n_estimators=100, random_state=42)
# Model training on training data
model.fit(X_train, y_train)
# Yield forecast
y_pred = model.predict(X_test)
# Evaluation of results
mse = mean_squared_error(y_test, y_pred)
print(f" Mean squared error: {mse}")
```

Conclusions. Therefore, the application of artificial intelligence and machine learning can significantly improve the productivity, profitability and sustainability of agriculture, as well as help solve the problems associated with global climate change and world population growth.

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