ARTIFICIAL INTELLIGENCE TECHNOLOGY IN MEDICINAL AND AROMATIC PLANTS (MAPS)

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INTRODUCTION

Artificial intelligence (AI) technology is rapidly transforming various industries, and the field of medicinal and aromatic plants (MAPs) is no exception. With the increasing demand for natural and plant-based products in the pharmaceutical, cosmetic, and food industries, the application of AI in the MAPs sector is gaining momentum. AI can be used to analyze large amounts of data related to the chemical composition, growth patterns, and medicinal properties of MAPs. This can help researchers and growers to identify new compounds with therapeutic potential, optimize cultivation practices, and ensure product quality and safety.

Furthermore, the application of AI in the MAPs sector can help to promote sustainability and biodiversity by facilitating the identification of novel compounds from underutilized or endangered plant species. This can help to conserve valuable plant resources and reduce the reliance on synthetic chemical compounds. Overall, the integration of AI technology in the MAPs sector offers numerous opportunities for innovation and growth. As the demand for natural and sustainable products continues to rise, the use of AI can help to unlock the full potential of MAPs and contribute to the development of new and effective treatments, cosmetics, and food products.

HOW DOES AI TECHNOLOGY WORK?

The specific workings of AI technology in MAPs can vary depending on the application and the specific AI algorithm used. However, in general, the process involves the following steps:

1. Data collection:
AI algorithms require large amounts of data to train and learn from. In the context of MAPs, this data can include chemical composition data, plant images, and information on plant growth and development.

2. Data pre-processing:
Once the data is collected, it needs to be cleaned and processed to ensure that it is of high quality and can be used effectively by the AI algorithm.

3. Algorithm selection and training:
AI algorithms vary depending on the application and can include deep learning models, support vector machines, decision trees, and others. The selected algorithm is then trained on the pre-processed data to learn patterns and relationships between the input data and the output prediction or classification.

4. Model validation and optimization:
The trained model is then tested on a separate dataset to ensure that it is accurate and reliable. The model can be optimized by adjusting its parameters and retraining it on the data until it achieves the desired level of accuracy.

5. Deployment and integration:
Once the AI algorithm is trained and validated, it can be deployed and integrated into MAPs research and development processes. This can include automating tasks such as plant identification, phytochemical analysis and disease diagnosis.

The specific details of this process can vary depending on the application and the specific AI algorithm used (Fig1).

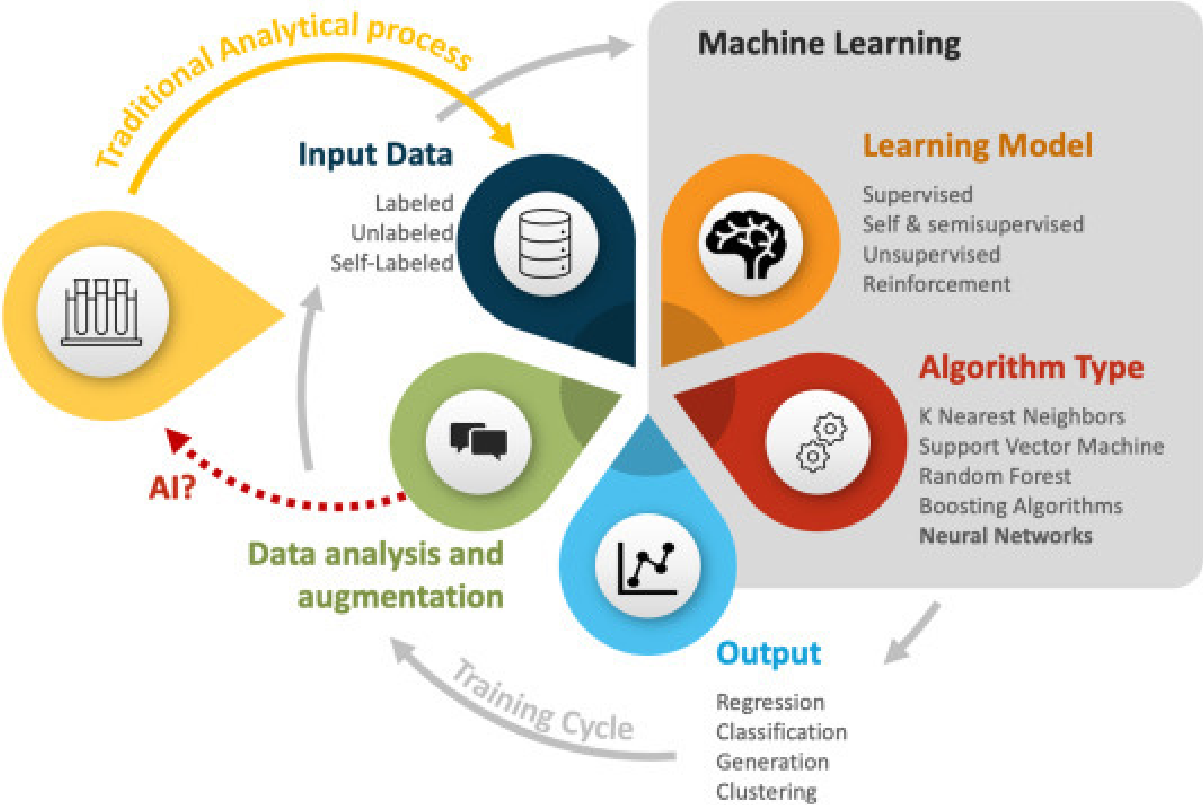

Fig 1: Analytical chemistry intersect with components of artificial intelligence

AI TECHNOLOGY IN MAPS

AI technology has been increasingly used in various aspects of medicinal and aromatic plants (MAPs), such as in plant identification, phytochemical analysis, and drug discovery. Here are some examples of successful AI applications in MAPs:

1. Plant identification:
Deep learning algorithms have been applied to plant identification using images of leaves or flowers. A conducted study a deep convolutional neural network to identify the species of 15 commonly used Chinese medicinal plants with an accuracy of over 90%.

2. Phytochemical analysis:
Machine learning algorithms have been used to analyse the chemical composition of MAPs. A study a random forest algorithm to predict the chemical compounds in the essential oils of Lonicera japonica with an accuracy of over 90%.

3. Drug discovery: AI has been used in virtual screening and drug design for MAPs. A deep learning algorithm in a study to predict the bioactivity of compounds from Chinese herbal medicines and identified several potential anti-cancer compounds.

4. Disease diagnosis:
AI has been used for the early detection and diagnosis of plant diseases in MAPs. A convolutional neural network to diagnose black spot disease in Rosa rugosa with an accuracy of over 95%.

5. Aroma analysis:
AI has been used to analyse the aroma compounds in MAPs. A deep learning algorithm to identify the key aroma compounds in green tea with an accuracy of over 90%.

6. Image analysis:
AI algorithms can help identify and classify MAPs based on their physical characteristics, such as leaf shape, colour, and texture. A study conducted using Naive Bayes Classifier (NBC), Classification and Regression Tree (CART), KNearest Neighbor (KNN), and Probabilistic Neural Network (PNN) classification as methods a deep learning model to classify medicinal and aromatic plants (MAP) namely St. John's wort (*Hypericum perforatum* L.), Melissa (*Melissa officinalis* L.), Echinacea (*Echinacea purpurea* L.), Thyme (*Thymus* sp.) and Mint (*Mentha angustifolia* L.) based on leaf shape, gray and fractal features with an accuracy of over 90%.

ADVANTAGES OF AI IN MAPS:

1. **Improved efficiency:** AI can automate various tasks, such as plant identification, phytochemical analysis, and disease diagnosis that would otherwise require extensive human labour and expertise. This can significantly improve the efficiency and speed of research and production processes.
2. **Increased accuracy:** AI algorithms can analyze large amounts of data and identify patterns and relationships that are difficult or impossible for humans to detect. This can lead to more accurate predictions and diagnoses and facilitate drug discovery and crop improvement.
3. **Cost-effective:** AI technology can reduce the cost of research and development by automating tasks and reducing the need for human labour and resources.
4. **Sustainable agriculture:** AI can help optimize crop management and reduce waste by predicting yield, identifying disease outbreaks, and optimizing irrigation and fertilization schedules. This can lead to more sustainable and environmentally friendly agricultural practices.

DISADVANTAGES OF AI IN MAPS:

1. **Dependence on data quality:** AI algorithms require high-quality data to make accurate predictions and diagnoses. Poor quality data or bias in the data can lead to inaccurate results and conclusions.
2. **Lack of interpretability:** Some AI algorithms, such as deep learning models, are difficult to interpret and explain. This can make it difficult for researchers to understand how the algorithm arrives at its conclusions and limit its use in certain applications.
3. **Limited availability:** AI technology requires specialized skills and resources to develop and maintain, which may not be readily available in some regions or communities.
4. **Ethical concerns:** The use of AI in drug discovery and development raises ethical concerns around patenting natural products and the exploitation of traditional knowledge and resources.

CONCLUSION:

The application of artificial intelligence (AI) technology in the field of medicinal and aromatic plants (MAPs) has the potential to bring significant benefits. Various studies demonstrated the potential of AI technology in various aspects of MAPs, from improving crop yield and disease diagnosis to drug discovery and aroma analysis. By leveraging AI to analyze large amounts of data related to MAPs, researchers and growers can identify new compounds with therapeutic potential, optimize cultivation practices, and ensure product quality and safety with accuracy. While AI has the potential to revolutionize the field of MAPs, it is important to carefully consider its advantages and disadvantages and ensure that it is used in an ethical and responsible manner. The integration of AI in the MAPs sector offers opportunities for innovation and growth, contributing to the development of new and effective treatments, cosmetics, and food products. Therefore, the use of AI technology in the MAPs sector represents a stimulating area of development that could have a profound impact on human health and the environment.