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Teaching AI Thinking to Primary Students Through Spreadsheets

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Abstract. This paper presents an innovative approach to teaching Artificial Intelligence (AI) thinking to primary students through hands-on activities using spreadsheets, developed as part of the Stardusts Science Education Program. The program aims to demystify core AI concepts—prediction, classification, and learning—by demonstrating how AI works rather than just how to use it. Utilizing familiar tools like spreadsheets and real-world analogies, the curriculum is structured into four levels: Classification Basics, Recommendation Systems, Spreadsheet Neural Networks, and Galaxy Classification. Each level incorporates gamification and scaffolding to make abstract mathematical concepts tangible. Key activities include human classification games, group-based prediction for recommendation systems, building simple neural networks in spreadsheets to predict crop yield, and applying AI concepts to classify galaxy images. The program emphasizes connecting daily life examples (e.g., YouTube algorithms) to scientific applications (e.g., astronomy), fostering curiosity and critical thinking. This initiative underscores the potential of spreadsheets as an accessible educational tool for introducing complex AI principles to young learners.

Keywords. AI Education, Primary Students, Spreadsheets, Hands-on Learning, Astronomy Education, Machine Learning Concepts

1. Introduction and Motivation

The pervasiveness of artificial intelligence (AI) in everyday life, from video recommendations to voice assistants, makes it a critical subject for modern literacy. However, primary education often lacks resources to teach the fundamental principles of AI, leading to a gap where students are consumers of technology rather than understanding its mechanics. The goal of our work is to address this gap.

We contend that the core concepts of AI—classification, prediction, and learning from data—can be effectively taught at a primary level without requiring advanced programming or complex mathematics. The key is to use relatable analogies and powerful, ubiquitous tools that make abstract concepts concrete. For a detailed visual overview of the program structure and activities, readers are encouraged to refer to the supplementary poster material provided with this proceeding.

2. Methodology: A Scaffolded Learning Sequence

Our curriculum is structured into a series of scaffolded levels, each building on the last to gradually construct a mental model of how AI systems learn.

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2.1. *Level 1: Introduction to Classification*

The session begins with a discussion hook: "What is AI?" Students analyze examples (e.g., a cleaning robot) and non-examples (e.g., a high-speed train) to derive a simple definition: AI is a system that learns patterns from data to make decisions. This is immediately followed by a human classification game. Students first classify clear images (e.g., cats vs. dogs), then ambiguous ones (e.g., a Chihuahua dog vs. a muffin), and finally, unfamiliar symbols (e.g., Thai vs. Hebrew letters). This activity leads to the key insight: "How humans classify is how AI learns patterns." We learn by identifying features and adjusting our understanding based on correct or incorrect guesses.

2.2. *Level 2: Building a Recommendation System*

The concept of using data for prediction is introduced through a relatable scenario: determining whether a new user on a video platform, Mary (a 9-year-old girl), would prefer Doraemon or Pokémon. Students are given a dataset of existing users (Name, Gender, Age, Preference) and guided to create a pivot table in a spreadsheet (see supplementary poster material).

By tabulating and visualizing the data, students discover patterns, such as "most girls in this group prefer Doraemon." They then make a prediction for Mary based on the group she most closely resembles. This activity introduces the AI concept of group-based prediction or simple clustering, demonstrating how algorithms use profiles to make recommendations.

2.3. *Levels 3 and 4: From Linear Regression to Neural Networks*

Subsequent levels (covered in-depth in the supplementary poster) use spreadsheets to model more advanced concepts. Students define features (e.g., size, sharpness of a celestial object), assign initial "importance weights" (e.g., w1, w2), and use a simple linear function to make a prediction (e.g., =x1*w1 + x2*w2). The model's error (prediction vs. actual answer) is calculated automatically. Through a process of manual weight adjustment, students experience the core of machine learning: minimizing error to improve prediction accuracy. Color-coding cells for weights and errors provides immediate visual feedback, turning the spreadsheet into a dynamic learning canvas. This culminates in a conceptual understanding of a neural network as a system that automates this weight-adjustment process at a massive scale.

3. Educational Design and Implementation

Successful implementation relies on key pedagogical strategies:

(1) Scaffolding: Pre-teaching basic spreadsheet functionality is essential. Complex terms like "neural networks" are simplified to "importance weights" (w1, w2, etc.).
(2) Gamification: Activities are framed as puzzles and games, maintaining engagement and reducing anxiety around mathematics.
(3) Tangible Connection: Continually linking activities back to real-world applications (e.g., "This is how YouTube knows what you like") reinforces relevance and deepens understanding.

4. Conclusion and Impact

This approach successfully demystifies AI for young students. By using spreadsheets, we transform abstract mathematical concepts into interactive, visual, and manipulable

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experiences. Students learn that AI is not magic but a logical process of finding patterns in data.

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