

How AI Software Programs Are Different From Normal Programs

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Recently one of my friends asked: how is an AI program different from normal software like paying for a book on Amazon.com. I thought it was a great question. Here's an explanation:

A computer program **automates** one or more **tasks**. You provide the computer **inputs**, and the computer produces a **result** or **output**. Examples of tasks that can be automated with a computer program are: multiplying large numbers, paying for items on an online shopping site, spam detection etc.

NORMAL COMPUTER PROGRAM: If you look very closely at the first two examples (i.e., multiplying numbers, paying for an item on an online shopping site), you will notice that in each case there is **only one correct answer**. In other words, multiplying 123 by 456 and then by 789 can only result in one answer, and there is one correct amount that needs to be paid for the item on the online shopping site. A task with only one correct answer is known as a **deterministic** problem. This is the type of task that is automated by a **normal computer program**.

While writing a computer program can be a challenging task, the basic steps to write a normal program can be summarized as:

Step 1: **explain** solution **in words**, such as “first ask which numbers to multiply, then multiply the first by the second, then multiply the result by the third.

Step 2: list **sequence of steps (i.e., algorithm)** that the computer needs to take to solve that problem.

Step 3: **translate algorithm into words that a computer will understand** (i.e., a computer program) by using a programming language, such as Python

AI PROGRAM: Let's contrast the above examples (i.e., multiplying three numbers, paying for an item on a shopping site) with a different task: spam detection in your e-mail. It is impossible to describe what spam is without examples of spam (i.e. without data). Is it possible to specify a rule to identify spam? It depends on the context. What may seem like spam (e.g., an e-mail with a subject “You just won \$1 million. Please open email”) for one application may not be spam for another one. Whenever the phrase “it depends” is used, we say that there is potential for variability in the computer's response.

A situation or problem where there is potential for variability in the answer is known as a **stochastic** situation. A stochastic situation is one where there are different outcomes possible. Instead of going into a lengthy discussion of what a stochastic problem is, for the purpose of this discussion I will summarize the concept and relevance to AI as :

AI is used to perform a task in an environment with **uncertainty** (and is therefore a stochastic problem) and **where one needs examples to derive the rules (i.e., the algorithm) to produce the result**. In contrast, a normal program does not need examples of the data to derive the algorithm.

TRAINING AND INFERENCE: Two terms that you will come across in almost any discussion of AI are **training** and **inference**. If you remember I had mentioned that writing a normal software program requires one to list the sequence of steps (algorithm) to solve the problem, and then write the program. Creating an AI model to solve a problem, such as detecting spam, is analogous to writing a normal program.

The **process of creating an AI model** to perform a task is known as **training**. Just as there are steps to produce a normal program, training also involves steps. Here is a simplified version of the steps to produce an AI program

Step 1: Get **data**

Step 2: Derive **algorithm from data** (i.e. produce trained model) (The process of deriving the algorithm is known as **optimization**, a topic for another discussion)

Once you have a trained model you can use the model to perform tasks such as identifying spam, predicting housing prices etc. When a trained model produces a result or an answer, that action is known as **inference**.

The next time someone asks you how an AI program is different from a normal program, you can say something like:

A normal program automates a task where there can be only one answer (also known as a deterministic task). In contrast an AI program automates a task where the answer can vary depending on the context (also known as a stochastic task).