

Find information about DSS, decision-support and the different reasoning strategies. What are they? When should they be used? Benefits and Drawbacks?

DSS, or rather decision support systems are programs that help out with decision making in activities. They can be classified into five different categories: data, documentation, knowledge, communications or model driven to complete certain tasks. They can be used in AI systems for accessing information in legacy IT systems, assumptions based on some financial data or analyzing consequences of different decision alternatives, given past experience in a specific context.

They are often written in a certain reasoning method languages, where the most popular reasoning strategies are deductive, inductive and abductive reasoning.

Deduction is when the conclusion taken is straight result of the facts that are currently presented. This is by far the most popular reasoning strategy for people who have learned math. A good example could be something like "Zeus is a god. All gods are immortal. Zeus is immortal". Deductive reasoning is often used to apply theories or subject to a specific situations. This method is great for proofing a single solid fact but it limits us to that single fact. It can often fail if we do not have 100% knowledge of the fact's application domain. For example, we do not know everything about the space thus we cannot state a deductive based fact about it.

Inductive reasoning is a little bit more loosey goosey, since we often made broad generalization conclusion from a specific observation of data. An example of this might be something like "There are people who play computer games. People that play computer games tend sometimes get really angry because of bad internet and leave the game. People that play computer games are easily pissed off". Inductive reasoning is therefore often used to form theory or subject based on situation. The method surely opens up more possibilities since the reasoning isn't restrictive which is more beneficial to problem solving. On the other hand, it might lead us astray from the correct solution since we can make the data belong to our assumption.

The last type of reasoning is the provided example.

Holmes walks into the old second hand store and looks across the counter. The man standing there glances up before returning to his bookkeeping. Holmes turns to his companion and says, "That, my dear Watson, is the man we are looking for."

"But Holmes, how on Earth can you know such a thing? You've not even spoken to him!"

"Ah, but you see Watson, it is simple. I noticed that his beard is ragged and untrimmed, but its style implies that it is usually well kept. This means that he had little or no time this morning to undertake his usual particulars. He is wheezing slightly, showing that he was out of the shop this morning in the dense smog we have been having all over London. And, of course, he is wearing the stolen watch on a chain in his waistcoat."

"Eee Gads Holmes, I just don't know how you do it!", exclaims Watson.

This type of reasoning is called **Abductive** reasoning and is often used to create explanations of an object or situation if it falls into the range of certain conditions. You create a hypothesis that could make up for a certain dataset that makes the most sense, that is, we try to presume a fact by using other known facts that support it. A good example of this would be if you saw a bicycle tire locked to a fence. Two hypothesis for the tire being there could be that someone wanted to keep his tire there until he needed it later, or someone locked the tire to the fence so the bicycle wouldn't get stolen. The

most likely reason would be that someone removed the bicycle from the fence and stole it and simply left the tire which leaves us with a better abductive inference. Thus, often used when suggesting theory to be tested out.

In this example, all of the clues about the man simply point to the description of the man he is looking for but nothing is certain. It could be that the man always had his beard ragged and that was his style. It could also be that he simply caught a cold and was simply sick. But by adding those two assumptions together along with the stolen watch, it makes up for a strong abductive reasoning.

Question 1

Consider outer space and black holes. A scientist wants to explain black holes for his fellow friends and uses the deduction "All black holes are so dense that nothing escapes it. Light that passes through a dense area will curve in that direction. Thus no light escapes a black hole". Is he correct? Can he make this assumption with deduction?

Deductive reasoning is usually used when we have established certain principles and facts that are known to be true. For every deduction used, we base it on a deduction we already know. Hence, all men are mortal is a known fact. All laws and aspects of outer space and specially black holes are unknown to us, thus we cannot make a deductive reasoning about it. Imagining or guessing the laws of black holes based on patterns we have used as examples. Thus inductive reasoning would be a better pick to propose a new hypothesis.

Question 2

Explain the main difference between deductive and abductive reasoning.

The deductive reasoning is good when we have a really narrow set of facts to deal with to give us a more precise answer, while the abductive reasoning is better when we have broader set of unrelated assumptions to find the best possible answer in multiple possible answers.

Question 3

A well-known statistical decision making tool is the Bays Theorem. Can you name a situation where this would be used?

This can be used in classifying spam emails. The system could analyze a set of emails that are marked as spam and others that are not (supervise learning). If a new email would arrive, the system could view the content of the email and see the probability of certain words that belong to spam emails such as "FREE", "XXX" or "WIN". The total probability of each word belonging to either spam or regular text could then be calculated and if it would pass a certain threshold, it could be marked as spam.

Question 4

Discuss how reasoning can be used in AI systems. Give an example of a program that uses decision support making.

Reasoning in AI can be used to gather a set of data to view all possible options to a problem. It could identify and diagnose problems, propose actions and evaluate these actions and the outcome of them.

An AI that is based on a decision support system could behave something like a bank cashier or financial adviser. It could analyze all of your current assets and accounts, view the current state of the market or currency and suggest if you should rather invest in stocks or pay down your loans. By doing so, it

could also view possible outcomes of the decision taken and calculate the risk of both good and bad possibilities happening.

Question 5

Decision support making software can be really beneficial in certain task but perform poorly in another. Name a case when such a system is beneficial and when it is not.

When the system is taking decision based on data seen before or known data, its accuracy can be just as good as or even better than human knowledge. On the other hand, if the data input and parameters are unknown to the system, performance and certainty can degrade when dealing with uncertain situations.

A good example of this could be a clinical machine that is really good at detecting cancer. If it would see a new virus that no one knew about before, it could not take proper action to deal with it.