

Hypothesis Testing

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Case of Murder trial

- Murder Accused is facing the trial in a court. The court looks at the evidence to judge whether the accused is innocent or Guilty
- What is the Null Hypothesis here?
- What is the Alternate Hypothesis?



Case of Murder trial

- Null Hypothesis
 - H_0 : The accused is NOT GUILTY (Innocent)
 - H_1 : The accused is GUILTY
- How do we test this hypothesis?
- Against evidence
 - What is the evidence available?
 - Often evidence is circumstantial and Not Conclusive
 - Eye witnesses
 - Fingerprint
 - Motives



Circumstantial evidence

- Null Hypothesis
 - H_0 : The accused is NOT GUILTY (Innocent)
 - H_1 : The accused is GUILTY
- Evidence 1
 - CC TV recorded the murder and the recording is available
- The argument : If the accused were indeed innocent (H_0 is true) what is the probability of having this evidence?
 - 0 %
- What is your decision ?
 - Not Guilty ? Guilty?
 - Accept or Reject Null Hypothesis
- What is your confidence in this decision?
 - What is the probability that you are wrong?
 - What is the consequence of your wrong judgment?



Circumstantial evidence

- Null Hypothesis
 - H_0 : The accused is NOT GUILTY (Innocent)
 - H_1 : The accused is GUILTY
- Evidence 2
 - Fingerprint of accused is found on the murder weapon -a knife
- The argument : If the accused were indeed innocent (H_0 is true) what is the probability of having this evidence?
 - 1 %

Circumstantial evidence

- What is your decision ?
 - Not Guilty ? Guilty?
 - Accept or Reject Null Hypothesis
- What is your confidence in this decision?
 - What is the probability that you are wrong?
 - What is the consequence of your wrong judgment?
 - An innocent person will get punished
 - A Guilty person will be acquitted
 - Which of these you want to reduce?
 - Can both be simultaneously reduced?

Circumstantial evidence

- Null Hypothesis
 - H_0 : The accused is NOT GUILTY (Innocent)
 - H_1 : The accused is GUILTY
- Evidence 3
 - Fingerprint of accused is found in the room where body was found
- The argument : If the accused were indeed innocent (H_0 is true) what is the probability of having this evidence?
 - 15 %

Circumstantial evidence

- What is your decision ?
 - Not Guilty ? Guilty?
 - Accept or Reject Null Hypothesis
- What is your confidence in this decision?
 - What is the probability that you are wrong?
 - What is the consequence of your wrong judgment?
 - An innocent person will get punished
 - A Guilty person will be acquitted
 - Which of these you want to reduce?
 - Can both be simultaneously reduced?

Circumstantial evidence

- Null Hypothesis
 - H_0 : The accused is NOT GUILTY (Innocent)
 - H_1 : The accused is GUILTY
- Evidence 4
 - Eye witness found the accused sharing a drink with the victim 2 hours before the time of death
- The argument : If the accused were indeed innocent (H_0 is true) what is the probability of having this evidence?
 - 70 %

Circumstantial evidence

- What is your decision ?
 - Not Guilty ? Guilty?
 - Accept or Reject Null Hypothesis
- What is your confidence in this decision?
 - What is the probability that you are wrong?
 - What is the consequence of your wrong judgment?
 - An innocent person will get punished
 - A Guilty person will be acquitted
 - Which of these you want to reduce?
 - Can both be simultaneously reduced?

Circumstantial evidence

- Null Hypothesis
 - H_0 : The accused is NOT GUILTY (Innocent)
 - H_1 : The accused is GUILTY
- Evidence 5
 - The accused had borrowed a large sum of money from the victim
- The argument : If the accused were indeed innocent (H_0 is true) what is the probability of having this evidence?
 - 90 %

Circumstantial evidence

- What is your decision ?
 - Not Guilty ? Guilty?
 - Accept or Reject Null Hypothesis
- What is your confidence in this decision?
 - What is the probability that you are wrong?
 - What is the consequence of your wrong judgment?
 - An innocent person will get punished
 - A Guilty person will be acquitted
 - Which of these you want to reduce?
 - Can both be simultaneously reduced?

Result Possibilities

		Jury's Decision	
		Not Guilty	Guilty
Defendant's True Status	Innocent	Correct Decision	Innocent person goes to jail
	Guilty	Criminal goes free	Correct Decision



Hypothesis Testing: Result Possibilities

	We Reject H_0 . (accept H_a)	We Fail to Reject H_0 (not enough evidence to accept H_a)
H_0 is true.	Type I Error	Correct Decision
H_0 is false. (H_a is true)	Correct Decision	Type II Error