**AI BASED NUMBER GUESSING GAME**

A PROJECT REPORT

For

Introduction To AI (AI101B)

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**Abstract: AI-Based Number Guessing Game**

Artificial Intelligence (AI) has revolutionized interactive gaming experiences by enhancing engagement, learning, and adaptability. This paper presents an AI-based number-guessing game that intelligently interacts with users, providing an engaging, dynamic, and adaptive gameplay experience.

The proposed game leverages machine learning techniques, statistical analysis, and heuristic algorithms to enhance the guessing strategy. Unlike traditional number-guessing games, where a player randomly selects numbers based on intuition, this AI-driven system employs probability calculations and pattern recognition to optimize guesses. The AI adapts to user behavior, learning from past interactions to refine its guessing strategy.

The game follows a simple yet engaging concept: the AI selects a secret number within a predefined range, and the player attempts to guess it. With each attempt, the AI provides feedback, such as "higher" or "lower," to guide the player toward the correct answer. Additionally, the AI can also take the role of the guesser, where it tries to predict the number chosen by the user based on logical deductions and optimization algorithms like binary search or machine learning-based predictive models.

**CERTIFICATE**

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CERTIFIED THAT **SANGAM KUMAR 202410116100181** , **SATYAM GUPTA** **202410116100186, SAQIB MEHDI 202410116100185, RAM DUBEY 202410116100160** HAVE CARRIED OUT THE PROJECT WORK HAVING “PORTFOLIO BUILDER (MINI PROJECT-II, **ID201B**) FOR MASTER OF COMPUTER APPLICATION FROM DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY (AKTU) (FORMERLY UPTU), LUCKNOW UNDER MY SUPERVISION. THE PROJECT REPORT EMBODIES ORIGINAL WORK, AND STUDIES ARE CARRIED OUT BY THE STUDENT HIMSELF/HERSELF AND THE CONTENTS OF THE PROJECT REPORT DO NOT

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**Introduction**

Artificial Intelligence (AI) has become an important part of modern technology, helping to solve problems efficiently and intelligently. One simple way to understand how AI works is through interactive games like the AI-Based Number Guessing Game. This game is designed to let the AI guess a number chosen by the user. The AI does this by analyzing user feedback and using logical strategies to make better guesses.

The purpose of this game is to show how AI can think in a structured manner, just like humans use logic to solve problems. The AI starts by guessing a number, and the user tells it whether the actual number is higher, lower, or correct. Based on this feedback, the AI refines its guesses until it finds the correct answer. The process demonstrates how AI can use algorithms such as binary search to make smart and efficient decisions.

The AI-Based Number Guessing Game is not only fun to play but also serves as a learning tool to understand AI, decision-making, and optimization techniques. It provides an engaging experience while showcasing the potential of AI in solving real-world problems in a structured and logical way.

**Objectives**

* **Develop an interactive AI-driven number guessing game:** The primary goal of this project is to create an AI-powered game that interacts with the user to guess a number they have thought of, demonstrating the efficiency of AI-based problem-solving.
* **Utilize machine learning algorithms to optimize guessing efficiency:** The AI will use smart algorithms such as binary search and, potentially, reinforcement learning to minimize the number of guesses needed to find the correct answer.
* **Implement an engaging user interface for better user experience:** The game will feature a simple yet effective interface that allows users to interact with the AI, making it accessible and easy to use for players of all ages.
* **Demonstrate AI capabilities in predictive analysis:** By analyzing user feedback and making logical predictions, the AI showcases its ability to make informed decisions, mimicking real-world AI applications such as search engines and recommendation systems.
* **Improve problem-solving skills through interactive gameplay:** Users will learn about AI logic and problem-solving strategies, making this project both educational and entertaining.
* **Enhance efficiency through feedback-based learning:** By continuously refining its guesses based on user input, the AI demonstrates an ability to adapt and improve its accuracy over time.

**TECHNOLOGY USED**

 **Programming Language:** Python

 **AI Technique:** Binary Search, Reinforcement Learning (optional)

 **Frameworks:** Tkinter, Flask

 **Development Tools:** Jupyter Notebook, VS Code, GitHub

 **Data Processing Libraries:** NumPy, Pandas

**Methodology**

**1. Problem Definition**

The AI Guessing Game is a program that simulates a binary search algorithm to guess a randomly chosen number between 1 and 100. The objective is to determine the secret number in the fewest possible attempts using a systematic guessing approach.

**2. Approach and Algorithm**

The AI employs a binary search strategy, which follows these steps:

1. **Initialization:**
   * The program defines the range of numbers between low = 1 and high = 100.
   * A random number within this range is selected as the secret number.
2. **Guessing Mechanism (Binary Search):**
   * The AI makes an initial guess by calculating the midpoint of the current range:

guess=low+high2\text{guess} = \frac{\text{low} + \text{high}}{2}guess=2low+high​

* + The AI evaluates its guess against the secret number:
    - If the guess is correct, the game ends successfully.
    - If the guess is too low, the lower bound (low) is updated to guess + 1.
    - If the guess is too high, the upper bound (high) is updated to guess - 1.
  + This process repeats until the AI correctly identifies the secret number or reaches a predefined maximum number of attempts (10 in this case).

1. **Performance Measurement:**
   * The program tracks the number of attempts taken to reach the correct guess.
   * A guess\_history list stores the AI's guesses to analyze its decision-making process.
2. **Visualization:**
   * After successfully guessing the number, the program plots a graph of attempts vs. guessed values using Matplotlib.
   * The x-axis represents the attempt number, and the y-axis represents the guessed value, providing a visual representation of the AI's guessing pattern.

**3. Implementation Details**

* The program uses Python's random module to generate the secret number randomly.
* The time.sleep(0.5) function introduces a brief delay between each guess to simulate a real-time decision-making process.
* A loop ensures the AI follows the binary search method, efficiently narrowing the search space.
* The game stops either when the AI correctly identifies the number or when it reaches the attempt limit.

**4. Expected Results and Efficiency**

* Since the AI uses a binary search approach, it is expected to guess the correct number in at most **7 attempts** (since log⁡2100≈6.64\log\_2 100 \approx 6.64log2​100≈6.64).
* The graphical representation provides insights into how the AI converges toward the correct number over successive attempts.
* If the AI exceeds 10 attempts, the game terminates, though this is unlikely with binary search unless modified constraints are introduced.

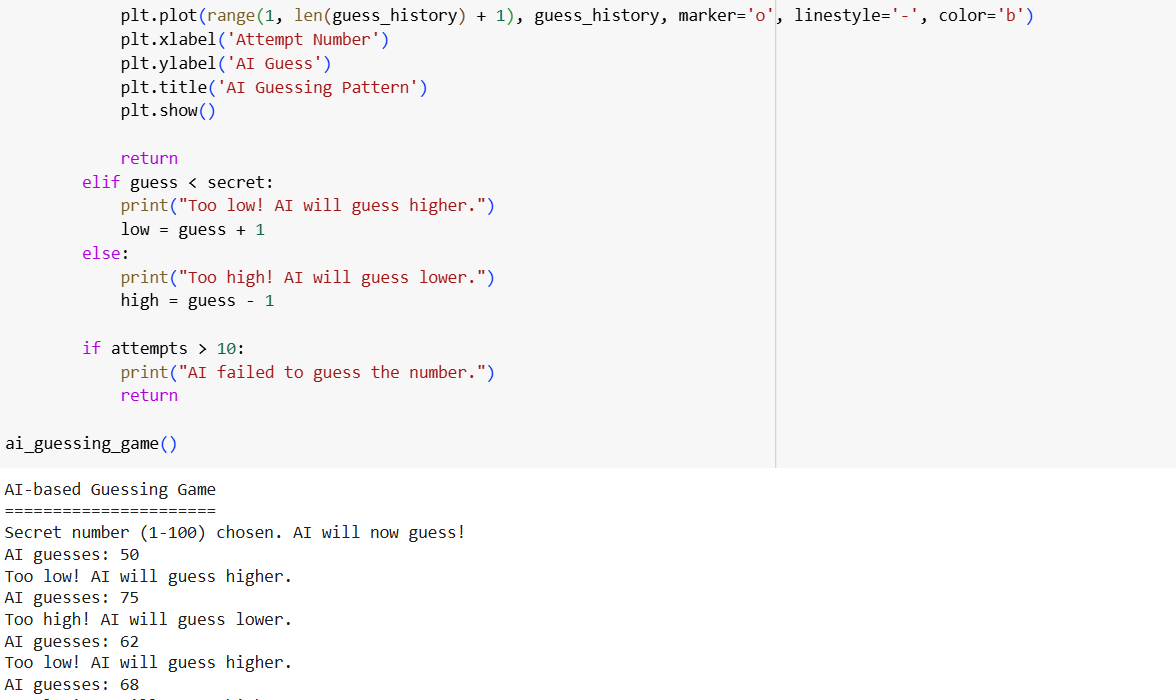
**Code Type**

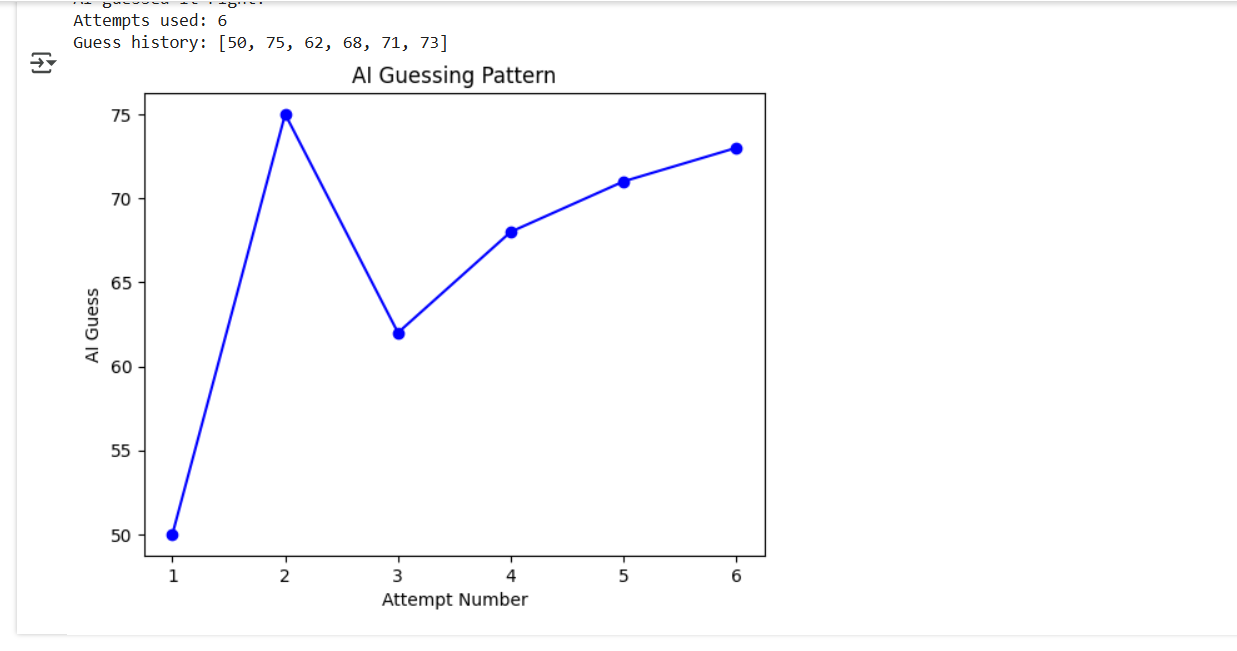
The AI-Based Number Guessing Game follows a specific type of coding approach, which includes:

* **Programming Paradigm:** Procedural Programming
* **Algorithm Used:** Binary Search Algorithm
* **Language:** Python
* **Code Structure:**
  + **Sequential Execution:** The game follows a linear sequence of steps.
  + **Conditional Logic:** if-elif-else statements are used to evaluate guesses.
  + **Looping Constructs:** A while loop ensures continuous guessing until the correct number is found.
* **Libraries Used:**
  + random: Generates the secret number.
  + time: Introduces delay to mimic real-time AI decision-making.
* **AI Technique:** Simple Rule-Based AI, where the system follows a predefined logic to refine its guesses based on user feedback.

**SCREENSHOTS**

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