Project work – AI &ML

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AI-Enhanced Wildlife Corridor Identification and Prediction

"**AI-Enhanced Wildlife Corridor Identification and Prediction**" generally refers to using **artificial intelligence (AI)** techniques (like machine learning, deep learning, or spatial analysis) to **identify, map, and predict wildlife corridors**.

Wildlife corridors are natural pathways or connections between habitats that allow animals to move, migrate, find food, reproduce, and maintain genetic diversity. For example: forest strips, riverbanks, grasslands, or even man-made green bridges over highways.

Here's what the phrase means, broken down:

1. AI-Enhanced

- Using AI tools such as:
    - **Remote sensing + satellite imagery analysis** (to detect land use, deforestation, human settlements).
    - **Machine learning models** (to analyze animal movement data from GPS collars, camera traps, and drones).
    - **Predictive modeling** (to forecast future changes in habitat connectivity due to urbanization, climate change, etc.).

2. Wildlife Corridor Identification

- AI helps **map current pathways** animals use to travel between habitats.
- It identifies **critical zones** where connectivity is strong and **fragmented zones** where corridors are blocked by roads, cities, or agriculture.
- Example: Detecting elephant corridors in India or jaguar corridors in South America.

3. Prediction

- AI models can **simulate future scenarios**:
    - How corridors may shrink or shift due to climate change.
    - Predicting **conflict hotspots** (where animal movement may overlap with human settlements).
    - Suggesting **new artificial corridors** or **protected areas** to maintain connectivity.

So, I got the topic called 'Predict the Next Location of Species.'

PREDICT NEXT LOCATION OF SPECIES

"Predict next location of species" is a crucial and highly advanced application within **wildlife ecology** and **conservation biology**, directly enabled by techniques like **Artificial Intelligence (AI)** and **machine learning (ML)**.

It involves using complex analytical models to forecast the future position of an individual animal or a population of a species across a landscape.

How Location Prediction Works

Predicting a species' next location typically relies on three main types of data and modeling approaches:

1. Movement Ecology Models (Short-Term Prediction)

These models focus on **individual animal behavior** and are used for near-real-time safety or management:

- **Data Input:** Real-time data from **GPS/Satellite collars** or **VHF transmitters** on tagged animals, combined with instant environmental readings (e.g., weather).
- **Modeling:** Algorithms like **Hidden Markov Models (HMMs)**, **Kalman Filters**, or **Deep Learning Recurrent Neural Networks (RNNs)** analyze the animal's path (speed, turning angle, time of day) to predict the most probable location in the next few hours or days.
- **Application:** Critical for **Human-Wildlife Conflict Mitigation**, such as predicting when elephants might approach human settlements or when a large carnivore might cross a busy road.

2. Species Distribution Models (SDMs) (Long-Term Prediction)

These models focus on **habitat suitability** and are used for strategic conservation planning:

- **Data Input:** Historical occurrence records of the species, environmental variables (climate, rainfall, temperature), and land cover data (forests, water bodies, roads).
- **Modeling:** ML algorithms like **MaxEnt (Maximum Entropy)**, **Random Forests**, and **Generalized Additive Models (GAMs)** correlate where the species *is* with the habitat characteristics, then project this correlation onto the entire landscape.
- **Prediction:** The model produces a **probability map** showing which areas are most suitable for the species' long-term survival and distribution, especially under future scenarios (e.g., climate change).

3. Agent-Based Models (ABMs) (Simulated Prediction)

These are simulation tools that help understand complex interactions:

- **Data Input:** Rules governing individual animal behavior (e.g., "if hungry, move toward water," "avoid humans"), resource distribution, and landscape barriers.

- **Modeling:** The simulation creates "agents" (virtual animals) that follow these rules, allowing researchers to observe and predict **large-scale movement patterns**, dispersal, and how a population might explore a new corridor or avoid a new barrier (like a fence or highway).
- **Application:** Used to predict the success of a newly constructed **wildlife corridor** or the spread of an invasive species.

The technique is used in this AI/ML programme :

Random Forests/Support Vector Machines, Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs) / LSTMs.

The data input from **GPS/Satellite collars** or **VHF transmitters :**

The working code for this:

https://github.com/vivek25scs1003004032-rgb/wildlife-tracker-simulation

THIS REPORT WRITING IS 30% OF THIS PROJECT, THE REMAINING WILL BE SUBMITTED BY ENDSEM