# 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.