

## Part 2: Task 3 – Ethics in Personalized Medicine.

**Title:** Ethical Challenges and Fairness in AI-Based Personalized Cancer Treatment

### Potential Biases in AI Models

- **Underrepresentation of Minority Groups:**
  - AI models trained predominantly on genomic data from specific ethnicities may **misrepresent or overlook** biological patterns in underrepresented groups.
  - This leads to **biased predictions** and suboptimal treatment recommendations for African, Asian, Indigenous, or Hispanic populations.
- **Sample Imbalance in the Dataset:**
  - The Cancer Genomic Atlas may contain more data from specific cancer types or stages, causing **class imbalance**.
  - Treatments suggested by AI might favor well-represented types and **ignore rare or complex cases**.
- **Data Quality and Missing Annotations:**
  - Missing or incorrect demographic/clinical annotations may influence the model's decision-making process, **amplifying existing health disparities**.

### Fairness Strategies to Mitigate Bias

- **Diverse Data Collection:**
  - Actively gather **genomic data across various ethnicities, age groups, and genders** to train balanced AI models.
  - Collaborate with global health institutions to enrich datasets.
- **Bias Detection Audits:**
  - Use **algorithmic fairness metrics** (e.g., Equal Opportunity, Demographic Parity) to test models before deployment.
  - Audit treatment recommendations by checking how frequently underrepresented groups are flagged incorrectly.
- **Transparent AI Decisions:**
  - Implement **explainable AI (XAI)** techniques such as SHAP or LIME to understand how predictions are made.
  - Help clinicians **trust and interpret** AI outputs ethically.

- **Human Oversight:**

- Keep human experts in the loop to **review sensitive decisions**, ensuring AI acts as a support tool and not a final decision-maker.

Personalized medicine powered by AI promises great advances, but ethical AI development ensures it benefits **all patients fairly**, regardless of their background.

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### **Part 3: Futuristic Proposal – AI Application for 2030**

**Title:** SkySentinel 2030 – AI-Powered Autonomous Climate Defense System

#### **Problem It Solves**

- Global warming is accelerating at an alarming pace, with climate tipping points like **Arctic ice loss, wildfires, and droughts** intensifying.
- Human response is often **slow and reactive**; we need **real-time autonomous climate mitigation**.

#### **AI Workflow**

- **Data Inputs:**

- Satellite imagery, drone feeds, real-time weather data, carbon emission sensors, ocean salinity, and temperature data.

- **Model Types:**

- **Multimodal deep learning model** to fuse diverse datasets.
- **Reinforcement learning** agent trained in simulated Earth systems to optimize interventions.
- Predictive models using **time-series forecasting** to anticipate disasters before they happen.

- **Actions:**

- Autonomous deployment of cloud seeding drones to prevent droughts.
- Adjusting marine cloud brightness to **cool regional temperatures**.
- Smart CO<sub>2</sub> scrubber networks to clean city air dynamically.

#### **Societal Risks and Benefits**

##### **Benefits:**

- Prevent extreme weather events and **reduce disaster response costs**.
- Save lives by **automating early intervention**.
- Help achieve **climate justice** by protecting vulnerable nations most affected by climate change.

**Risks:**

- Overdependence on AI for **geoengineering** may lead to **unintended ecological consequences**.
- Possibility of AI being **misused by governments** to control weather for political gains.
- Lack of global consensus could result in **AI climate wars** or ethical disputes.