Team Members:

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Note - both of the ideas datasets can be formed by data scraping YouTube or any other video streaming app

Idea 1

Objective: The goal is to create a tool that uses video analysis to monitor the movements of key body joints during exercise. The system will compare the detected movement patterns against established correct movement patterns for various exercises. If any discrepancies are found—such as a joint moving out of sync or a body part not following the correct path—the system will alert the user, allowing them to correct their form before injury occurs.

Datasets (Annotation Refers to If Dataset Has Existing Joints Detected):

- https://www.kaggle.com/datasets/hasyimabdillah/workoutfitness-video (Video Dataset / Not Annotated)
- https://weighttraining.guide/exercises/ (Image and Text Dataset / Data Mining / Not Annotated)
- https://arxiv.org/abs/1702.05693 (Image dataset / Annotated)
- https://www.crowdhuman.org/ (Image Dataset / Annotated)
- http://vision.cs.stonybrook.edu/~supreeth/BodyHands/ (Image Dataset / Annotated)
- Further data collection and collaboration with physical education instructors at UMKC
- Data mining YouTube videos from selected influencers and educational content

Existing Projects:

- Corrective Posture Estimator (https://www.itm-conferences.org/articles/itmconf/pdf/2021/05/itmconf_icacc2021_03031.pdf)
- Reddit Project - Shoulder Press for Arm Raises and Posture Check(https://www.reddit.com/r/learnmachinelearning/comments/mdwxcg/my_mate_and_i_made_a_program_for_counting_reps/)
- Perch.fit - Professional Program and Hardway to check athletes to evaluate performance during workouts. Not clear whether posture is checked or relied on by professionals. (https://www.perch.fit/case-studies/what-sets-perch-apart)

Applications:

- Giving real-time feedback to users during workouts from their phone
- A low-cost solution for gyms to use simple hardware to provide a resource for simple exercises

Target Population:

- New/Young gym goers who don't have too many underlying conditions and are trying to learn exercises without hurting themselves or investing into the already expensive world of working out by paying for a personal trainer

Idea - 2

Purpose: Compound disasters, such as the simultaneous occurrence of hurricanes and pandemics like COVID-19 are intensified by social vulnerabilities. This project aims to develop an application that assesses these vulnerabilities at the county level by integrating mutliple data sources to evaluate potential risks and identify appropriate remedies. The application will provide real-time recommendations and alerts to optimize disaster preparedness and response strategies, ensuring that users and communities receive timely information on nearby shelters, available resources, and preparedness measures.

Objective: The goal is to develop a predictive model that combines demographic, socioeconomic, and environmental data to identify regions and population groups most vulnerable to compound disasters. The project will analyze how these events amplify existing vulnerabilities, affecting public health, infrastructure, and economic stability. The application will use these findings to send targeted alerts and recommendations to users, providing crucial insights to policymakers and emergency planners to optimize disaster response and recovery efforts.

Relevant Datasets:

- **API Web Service (weather.gov):** Weather Alerts API provided by the National Weather Service, delivering up-to-date weather alerts for local regions. API Web Service (weather.gov)
- **Drought.gov:** Maps, graphs, and more from NOAA's Climate.gov - NOAA Drought Monitor, providing insights into drought conditions that may exacerbate disaster risks. Drought.gov - Maps, Graphs, and More | NOAA Climate.gov
- **disease.sh Docs:** estimated COVID-19 case load data from global/country down to the county level, sourced from various open-source API calls, allowing for real-time or close to real-time monitoring of pandemic trends. disease.sh Docs

- **Social Vulnerability Index (SVI):** ranks communities based on their social vulnerability, which includes factors like poverty, lack of vehicle access, and crowded housing CDC/ATSDR Social Vulnerability Index (CDC/ATSDR SVI)

Approach:

- **Data Integration:**
  Collect and integrate data, including real-time weather alerts, demographic information, socioeconomic indicators, and environmental factors, to create a comprehensive dataset for analysis. The application will use this data to assess risk levels and deliver real-time alerts and recommendations to users based on their location.
- **Vulnerability Analysis:**
  Use advanced data analytics and machine learning techniques, such as Random Forest, CNNs, and LSTM networks, to identify patterns and correlations that indicate heightened vulnerability during compound disasters. The analysis will include social determinants of vulnerability, such as age, income, housing quality, and access to healthcare, ensuring that the alerts and recommendations are tailored to the specific needs of vulnerable populations.
- **Predictive Modeling:**
  Develop AI-driven models to predict which areas and populations are most at risk during disasters and additionally for the intersection of disasters like hurricanes and pandemics. The model will simulate various disaster scenarios, providing the basis for the application's alert system, which will notify users of potential risks and recommended actions.
- **AI-Driven Recommendations:**

  Leverage AI to analyze real-time data and model the effects of different disaster scenarios. Likely an LLM could be used to generate tailored recommendations for users based on their specific location and circumstances. These recommendations could include guidance on evacuation routes, nearby shelters, necessary supplies, and safety precautions. The AI-driven system will continuously update these recommendations as new data comes in, ensuring that users receive the most relevant and timely advice for disaster preparedness and response in their area.

- **Policy and Planning Support:**
  Generate actionable insights and recommendations for individual users and emergency planners. The application will provide tools for integrating these recommendations into existing policy frameworks and will offer a platform for disseminating alerts and preparedness information to the public.

Impact:

- **For Users & Communities:**
  By identifying at-risk areas, the application will enable targeted interventions and send real-time alerts, mitigating the impact of disasters/risks
- **For Emergency Planners:**
  Provides evidence-based insights to optimize disaster response and recovery strategies, ensuring that resources are allocated effectively. The application will also serve as a tool for disseminating critical information to the public.
- **For Public Health and Infrastructure:**
  - **Risk Mitigation:**
    Identifying vulnerabilities allows for proactive measures to protect public health and infrastructure. The application will send timely alerts to help mitigate the overall impact of compound disasters.
  - **Resource Allocation:**
    Helps ensure that medical and infrastructure resources are distributed where they are most needed during a disaster, with the application providing real-time updates on resource availability and location.

Future Potential:

- **Expansion to Other Disaster Types:**
  The model can be expanded to predict vulnerabilities in other types of compound disasters, such as wildfires combined with heatwaves, with the application adapting to provide relevant alerts and recommendations.
- **Global Application:**
  While initially focused on specific regions, the approach could be adapted for use in other countries facing similar compound disaster risks, with the application tailored to local conditions and integrated with regional alert systems.
- **Integration with Early Warning Systems:**
  The predictive models could be integrated with early warning systems to provide real-time alerts and preparedness recommendations directly to users' devices, enhancing the timeliness and effectiveness of disaster response.