- **Please make a copy before you edit it: File -> Make a copy.**
- **Please find the problem statement and detailed template below.**
- **From where the template starts you will be allowed only 3 pages for the solution summary**
- **Please submit the final solution document with an access link in the submission form**

Girl Hackathon 2024

[Do not edit this section. This is read-only]

AI for Social Good

Theme:

The evolution of AI has been nothing short of extraordinary. From humble beginnings, machines now learn, adapt, and even create with startling sophistication. Let's focus on using this power to address the challenges we face.
The greatest innovations are those that solve real-world problems and make a positive difference. This hackathon is a chance to create solutions that improve lives, streamline processes that make a tangible difference in healthcare, education, and sustainability, and countless other fields for the next billion users. Let's make this hackathon a testament to a future where AI isn't just intelligent – it's transformative.

Participants are encouraged to create an application or enhance existing platforms to achieve the following goals: **[Choose 1 of the following]**

Problem Statements:

- **Adaptive Learning for Basic Education:** Develop a virtual tutor platform that assesses the learner's understanding level at every step and curates relevant content to enhance the learning experience.
- **Disaster Relief:** Enhance disaster relief and response efforts by leveraging satellite imagery during disasters like floods and wildfires, integrating existing geospatial information, and utilizing environmental data for affected regions.
- **Medical Assistant:** Develop a healthcare recommendation system that analyzes user symptoms leveraging symptom data (using mock data), healthcare provider databases, and user ratings, recommends doctors with matching specialties and aligned schedules.

Goodluck!

Submission:

Participants are required to create a PDF document as the final submission. The document should contain the link to a public GitHub repository (accessible and open to all).

The repository should have all the collaterals of the code, along with a README file. The code can be written in any open-source programming language using standard open-source libraries.

The README file should cover how to generate the environment needed to run the code, how to run the code, and any other necessary information.

Evaluation Rubrics:

- Potential Impact of Proposed Idea (25%)
- Usage of correct DS/Algorithm and AI technique (40%)
- Code Quality (20%)
- Testing (15%)

2024 Girl Hackathon Ideathon Round: Solution Submission

Project Name: VisiCheck

Participant Name: Medha Kashyap

Participant Email ID: medha22292@iiitd.ac.in

Participant GOC ID: 666974664165

ReadMe File Links (Eg: Github): https://github.com/medhakashyap/VisiCheck

Brief summary:
Please summarize your problem statement and solution in a short paragraph.
Problem Statement: Develop a healthcare recommendation system that analyzes user symptoms leveraging symptom data (using mock data), healthcare provider databases, and user ratings, recommends doctors with matching specialties and aligned schedules.
Solution: I aspire to create a system dedicated to promoting eye health. It will help users by analyzing their symptoms, offering details about the current stage of any detected disease, and suggesting preventive measures. Additionally, the system will recommend appropriate eye specialists with available appointment slots to receive expert advice remotely. By analyzing eye images, the system can identify common eye issues such as cataracts or diabetes. The platform will offer Interactive Educational Modules that provide comprehensive information on various eye conditions, including their causes, symptoms, risk factors, and treatment options. These modules will utilize multimedia elements like videos, animations, quizzes, and interactive diagrams to create an engaging learning experience. Users will gain a deeper understanding of eye health topics, from cataracts to the significance of regular eye exams, enhancing their awareness and knowledge to promote better eye health.

Problem Statement:
What are you doing, why, and for whom?
Project Flow: Link
I'm developing a dedicated system for promoting eye health. It will analyze user symptoms, offer disease details, and suggest preventive measures. Additionally, users can remotely consult appropriate eye specialists with available slots. The system is aimed to identify common eye issues from images, like cataracts or diabetic retinopathy. Furthermore, it features Interactive Educational Modules with multimedia elements to educate users about eye conditions, symptoms, and treatment options, fostering better eye health awareness and knowledge. This initiative aims to combat the significant eye health challenges in India, where cataracts and diabetic retinopathy are major causes of blindness. With India accounting for 20% of global blindness due to cataracts as per the Times of India report and a high prevalence of diabetes, there is an urgent need to address eye health disparities. The system's focus on cheaper early detection, education, and access to specialized care is crucial, particularly for rural India, where healthcare access is limited. By overcoming barriers to healthcare services and providing proactive support, the system can significantly improve eye health outcomes and enhance people's quality of life.

Design Idea and Approach:

A short and sweet overview of your implementation ideas. You don't need to contain every detail of your implementation, and should omit code here specifically. Use a diagram that illustrates your solution when necessary.
You can discuss about this below but not limited to:

- **Which technologies will you use?**
  Cloud and Other Services: Google Cloud, Google AI Studio
  Frontend and Backend Development: HTML, CSS, JavaScript, Node.js, Python with Django or Flask.
  Database Management: MySQL, PostgreSQL, or MongoDB
  AI/ML: Python, PyTorch, OpenCV, NumPy, Pandas, Matplotlib, scikit-image, sklearn, TensorFlow, seaborn.
- **What new components will you write?**
  Instead of only detecting eye diseases like Diabetic Retinography and Cataracts, we aim to detect other eye diseases like Age-related macular degeneration, Glaucoma, etc. Additionally, a chatbot specialized in answering queries about eyecare and eye-related diseases. I also aim to incorporate multiple regional languages into the system to ensure broader reach and accessibility to diverse groups across India.
- **What technologies will you use to write them?**
  OpenCV, TensorFlow, PyTorch, scikit-learn, Pandas, NumPy, Matplotlib

- **What are the dominant scaling parameters? (data sizes, qps estimates, etc.) Consider the range and maximum values.**
  The dominant scaling parameters includes data sizes of symptoms data, health care provider databases, it is essential to consider the potential growth of these databases overtime and also varying datatypes, for not only detecting cataracts and diabetic retonopathy but also different eye diseases. Secondly, QPS estimates as it helps to determine the system's capability to handle concurrent user interactions effectively. Storage capacity - the system needs to accommodate large volumes of data, scalability in storage capacity ensures efficient data management & retrieval.
- **What is the general rollout strategy?**
  1. Development and Testing: Developing and testing system core functionalities thoroughly to ensure accuracy, reliability, and ease of use.
  2. Data Integration: Integrate mock symptom data, healthcare provider databases, user ratings, and eye image analysis into the system. Also, ensuring seamless data flow & compatibility between different system components.
  3. User Onboarding: The system will be launched, and users will be encouraged to register. They can upload their eye images for analysis, with AI algorithms detecting common eye issues and offering detailed insights. It then recommends suitable eye specialists and enables users to schedule virtual appointments.
  4. Interactive Educational Modules: Offer comprehensive educational modules covering various eye conditions, their causes, symptoms, risk factors, and treatment options. Use multimedia elements like videos and animations for the same.
  5. Continuous Improvement: Continuously update and enhance the system's functionalities, content, and user interface to meet evolving user needs and technological advancements. This can be done by gaining feedback from users, healthcare professionals, and experts to identify areas for improvement.
- **What are your information security/privacy concerns and how will you address them?**
  The leading information security and privacy concerns are the confidentiality, integrity, and availability of users' health data. To address these concerns, sensitive data can be encrypted using technologies like AES. RBAC and multi-factor authentication (MFA) can ensure that only authorized users access the data and ensure security & privacy regulations such as HIPAA (Health Insurance Portability and Accountability Act). I also aim to include robust authentication methods, like biometric or token-based authentication, to verify user identity.

The approach used to generate the algorithm.

- Diabetes Detection: This can be done using a CNN model in PyTorch for diabetic retinopathy detection using high-resolution retinal images. It starts with data preprocessing, including transformations and dataset creation, followed by visualization for data insights. Data loaders are then set up for efficient data handling. The CNN architecture is defined, including convolutional, max-pooling, and fully connected layers, with a summary displayed. Key components like the loss function, optimizer (Adam), and learning rate scheduler are defined. Utility functions aid in output shape computation and performance metrics. The training and validation process iterates over multiple epochs, monitoring metrics and saving the best model weights. This approach ensures the creation of an accurate and efficient CNN model for diabetic retinopathy detection. Accuracy = 94%
- Cataract Detection: Employed a CNN architecture (CataractModel) with convolutional blocks, ReLU activation, max-pooling, batch normalization, and dropout for cataract detection. Use CrossEntropyLoss, Adam optimizer, and Accuracy metric. Train and test functions handle batch processing, and visualization includes loss/accuracy curves, sample test image visualization, and confusion matrix plotting. Accuracy = 95-98%
- Educational Modules: Instead of hosting videos directly, the platform will embed YouTube using HTML iframe elements or JavaScript libraries like Plyr or Video.js to display relevant content about specific eye diseases.

Impact:

How will the proposed project address a societal challenge, and to what extent? Is the application grounded in research and data about the problem and the solution? Is there a clear plan to deploy the AI model for real-world impact, and what are the expected outcomes?

India accounts for 20% of the world's blindness cases, primarily caused by diseases like cataracts & diabetic retinopathy. Blindness causes social limitations & significantly impacts a country's growth; the net loss of GNI due to blindness in India is Rs. 845 billion. Rural India largely accounts for such cases, but access to specialized eye care services in such places is challenging. The system aims to reduce the gap between patients and specialized care by providing cheaper early detection methods, facilitating remote consultations with appropriate eye specialists, and offering available appointment slots. The application is grounded in extensive research & data analysis concerning prevalent eye conditions. This includes studying epidemiological data on eye diseases, understanding regional healthcare challenges, & examining the effectiveness of various tools & techniques. A well-defined strategy is in place to deploy this AI model for real-world applications. In brief, it can be done by hosting the application on a cloud platform or a dedicated server, users can access the system through

web/mobile applications & virtual appointments can be done through video conferencing platforms, allowing improved remote consultations. The expected outcomes include increased early detection of eye diseases, improved access to specialized eye care enhanced awareness of preventive measures, and reduction in the prevalence of blindness & associated socioeconomic burdens. Thus, it addresses the pressing need for accessible and affordable eye healthcare solutions across India, contributing to improved eye health outcomes on a national scale.

Feasibility:

Does the team have a well-developed, realistic plan to execute on the proposal? Does the team have a plan to access a meaningful dataset and technical expertise to apply AI to the problem? Have they identified the right partners and domain experts needed for implementation?

Yes, the team has a well-developed, realistic plan to execute the proposal, they have outlined clear steps and relevant datasets for analyzing user symptoms, recommending appropriate specialists, and providing educational resources. Additionally, they have identified key technologies, such as AI for image analysis, and proposed integration with telemedicine platforms for virtual appointments, ensuring a comprehensive and feasible approach to promoting eye health. We have identified key stakeholders, including healthcare providers, eye specialists, and potential partners like telemedicine platforms and also domain experts such as eye specialists (Ophthalmologists & Optometrists), data scientists with expertise in AI/ML who can develop efficient algorithms for the proposed solution, and UI/UX designers who can create intuitive and user-friendly interfaces for the platform, ensuring a seamless experience for users interacting with the system. The system is highly scalable because of its ability to reach diverse populations, especially in tier-2/3 cities and rural India, and its accessibility is in multiple regional languages. The system can cater to an expanding user base seeking eye health information and services by harnessing AI technologies and offering cost-effective and streamlined remote consultation features.

Use of AI

Does the proposal apply AI technology to tackle the issue it seeks to address?

Yes, the proposal applies AI technology to tackle the issue of promoting eye health. The system utilizes AI algorithms such as OpenCV image processing techniques to analyze user's eye images and a convolutional neural network (CNN) model implemented using PyTorch. CNN model analyzes high-resolution retinal images to detect signs of diabetic retinopathy and cataracts. It also utilizes AI recommendation algorithms or Natural Language Processing (NLP) techniques to analyze textual data such as user reviews, doctor profiles, and appointment descriptions.

Alternatives considered
Include alternate design ideas here which you are leaning away from.

1. For the mentioned problem statement instead of solely focusing on eye health, the system could offer medical assistance for a broader range of medical conditions. However, this will dilute the system's effectiveness thus making it less scalable and more prone to errors.
2. Incorporating a chatbot into the platform to facilitate voice-controlled interactions could significantly improve user experience and accessibility. Using natural language commands, users can inquire about eye health, report symptoms, or seek information on related topics. However, despite generating a custom dataset due to the absence of a processed dataset, the system only achieves a 4% accuracy rate, indicating insufficient accuracy and efficiency.

References and appendices:
Any supporting references, mocks, diagrams, or demos that help portray your solution.

- "Diabetic Retinopathy Detection Using Deep Learning," IEEE Conference Publication | IEEE Xplore. Link
- IEEE Conference Publication | IEEE Xplore. "Automatic Cataract Detection and Grading Using Deep Convolutional Neural Network," May 1, 2017. Link
- "Image Classification Using CNN | Deep Learning Projects | Machine Learning Tutorial | Simplilearn." Link
- Junayed, "CataractNet: An Automated Cataract Detection System Using Deep Learning for Fundus Images." Link
- Stats Wire, "Deploy Machine Learning Model Flask." Link

Demos:

- Project Flow Prototype made using Figma: Link
- Diabetic Retinopathy: CS3244: Machine Learning, "Diabetic Retinopathy Detection Using Machine Learning." Link
- Cataract Identification: XOOM PROJECTS, "Cataract Detection Using Convolutional Neural Network With VGG 19 Model." Link

Any public datasets you use to predict or solve your problem.

- "Diagnosis of Diabetic Retinopathy" | Kaggle." Link
- "Ocular Disease Recognition," Kaggle, September 24, 2020. Link