Morgan Bergen

Professor Huabo Lu

CS 598 Senior Design Project I

15 September 2024

Clarity Advanced Machine Learning for Nutrituonal Analysis and Healthcare Management

Clarity is the senior design project that is a web and mobile application that leverages machine learning to analyze the nutritional content of food. The application aims to empower users with real time dietary insights, allowing them to manage their chronic conditions, improve nutrition, and monitor overall health. Target users include patients with chronic conditions, athletes, personal trainers, health conscious individuals, and healthcare providers. Clarity will feature a comprehensive health management tool, providing nutritional analysis through image recognition, personalized dietary recommendations, health monitoring, and trend analysis, as well as data-sharing capabilities with healthcare providers.

The general architecture will consist of a front-end built with react native, a backend powered by node.js, express.js, pocketbase, for real time data management and authentication, and machine learning models integrated to perform image recognition and dietary analysis. The system will support cross-platform usage, making it accessible via web and mobile devices.

Our group consists of three members. Christal Shaner: Christal has experience in JavaScript, React.js, C++, Python, F#, SQL, R, PHP, Prolog, Material UI, and Git. She has worked as a Software Engineer at Ennovar and as a Web Developer at McCurdy Real Estate & Auction, LLC. Christal's strengths lie in frontend development and user interface design, making her a valuable asset to the team for building Clarity's user experience. Jason Heitman: Jason brings experience in C++, F#, SQL, and Linux. He is eager to expand his knowledge by learning

about cloud services and backend technologies, including PocketBase and database integration. Jason will focus on backend development, ensuring that Clarity's data flows smoothly between the front and back end. Morgan Bergen: Morgan's experience includes TypeScript, C, x86 Assembly, C++, Python, Solidity, Haskell, Verilog HDL, Git, Bash, and Zsh. As a former Software Engineer Intern at Ripple Labs in NYC, he is well-versed in full-stack development. Morgan will lead the architecture design, machine learning integration, and coordination of the technology stack for both the frontend and backend.

Several software products offer similar functionalities to clarity. Some of these competitors and their key features that we wish to implement include Calorie Mama, MyFitnessPal, and Lose it!. Calorie Mama uses image recognition for food identification and offers nutritional analysis. We plan to implement similar food recognition features using machine learning models. MyFitnessPal provides dietary tracking and personalized recommendations, we hope to include personalized meal plans and health insights in clarity based on users dietary habits and goals. Lose it! focuses on calorie counting and weight management, calorie tracking is not clarity's primary focus, we aim to integrate similar health monitoring features, allowing users to track nutrients and trends over time.

The following features are considered essential for clarity's functionality and will be the focus of our development. User profile and data input allows users to input personal health data, including age, weight, medical history, dietary preferences, and goals. Image capture and analysis will consist of a feature for users to capture or upload images of food or scan barcodes which will be analyzed for nutritional content using machine learning. Personalized dietary recommendations will be based on user input and image analysis, clarity will provide advice and meal plans. Health monitoring and trend analysis will track user health metics such as nutrient

intake, and provide insights on dietary trends. Disease risk management offers predictions on potential health risks based on diet. Data sharing with healthcare providers will enable users to export their health data and analysis for sharing with their primary care physician or any other healthcare professional. Lastly wearable integration will be a potential feature which will integrate with weasel devices to track biometric data like blood pressure and activity levels to provide more precise trend analysis. The first phase is to set up the project structure including front end, back end, and database. Then develop user registration and authentication system using pocketbase. Phase 2 will be to implement user health profile questionnaire and basic image capture and nutritional analysis, allowing users to view initial health insights. Phase 3 will be to extend the nutritional analysis feature adding personalized recommendations based on users' health goals, trends, and conditions. Phase 4 will be to build the health monitoring dashboard and disease risk management module. Phase 5 will be to implement data sharing with healthcare providers and ensure proper data export formats. Lastly phase 6 will be to finalize wearable integration, refine user interface, and conduct testing. Although each phase will have it's own quality assurance and testing throughout implementation stages. The technology stack will consist of a backend - node.js, express.js, pocketbase for authentication and real time data management. The front end will be of react.js, material ui, redux for state management, and axis for api requests. Machine learning will be of clarifai for food recognition and nutritional analysis. Cloud services may be with google cloud, and barcode scanning will be of open food facts api for nutritional information retrieval.

There are multiple factors that could potentially harm our progress such as procrastination and poor collaboration. To mitigate these factors will be to adhere to a details project timeline with clear milestones and deadlines, and make sure to ensure accountability for

weekly progress meetings Additionally we will maintain open communication using tools like github and messaging tools to track our work and ensure basic tasks are allocated and completed on time, in case of a conflict team discussion will be held to resolve issues properly. Our group is committed to the success of clarity and each member brings their own strength and values to the project and we will work collaboratively with frequent check ins to ensure that everyone stays on track and contributes to the project.

The mentors of our project will consist of professors in our department and particularly those with expertise in machine learning to mentor our project. We will request their guidance in regards to this class and make sure that we provide a presentation aiming to inform our mentor of our work and progress. The user experience will engage classmates and colleagues in testing the application. We will send emails and request meeting times from fellow classmates from our senior design project class and other students from the computer science department. Their feedback will help us refine the user interface, improve functionality, and make sure the application is intuitive and user friendly by asking quality assurance questions for their review of the project. Making sure that the application is at it’s optimum quality before the final release.