minoHealth: Using Artificial Intelligence and Data Analysis to Solve Healthcare In Africa

Submitted by Darlington Akogo (minoHealth) on January 19, 2018 - 4:46pm
Last revised by Web Producer on June 21, 2018 - 3:09pm.
Proposal Status: Out of Scope

Executive summary

We want grant funding from Digital Square to fasten our implementation and deployment of minoHealth. minoHealth is a startup and multifaceted system with the objective of democratising Quality Healthcare with innovative and cutting edge technologies like Artificial Intelligence and Biotechnology in Africa. minoHealth and its AI Research lab, minoHealth AI Labs researches and experiments with Artificial Intelligence and ways it can be applied to Healthcare to make it faster, better and yet, cheaper.

Currently, minoHealth is funded solely by the founder and his limited resources, which limits how fast we function and what we can do. But with this grant funding, minoHealth would be able to employ more programmers(and others) to fasten the process of implementing the research works to the main system for it to be deployed. minoHealth would also be able to afford more hardwares(like GPUs) for larger and faster Artificial Intelligence modelling. And we'd be able to afford larger cloud storages to house the complete implemented multisystem. We'd also be able to fund more research works, purchase and organise personnels to collect data for Artificial Intelligence modelling.

Consortium Team

We currently consist of minoHealth, 'minoHealth AI Labs' and 'minoHealth Research', with the first two currently being the most active. minoHealth is the main sector and it mainly focuses on implementing research models and innovative ideas as ready to be deployed and used technologies. It houses experts capable of developing Frontend systems with intuitive and easily usable interfaces and complex Backend systems, Data Storage and Analysis systems and setting up and Engineering Cloud Computing systems.

minoHealth AI Labs focuses mainly on researching and experimenting with Artificial Intelligence and its Application to Healthcare and the Medical Sciences. It houses Artificial Intelligence/Machine Learning Engineers, Data Analysts and also our many Academic collaborators from disciplines including Biotechnology, Optometry/Visual Science and Nutrition/Dietetics.

minoHealth Research focuses on researching other domains and cutting edge technology outside of Artificial Intelligence for it to be implemented and deployed in minoHealth system. It currently houses a Biotechnologist.
We'd also be using this grant to grow all three teams and allow them to move at faster pace. In addition, we seek collaborators that can assist us to easily deploy our final systems.

Project Description

minoHealth is a multifaceted system that combines Artificial Intelligence, Biotechnology(currently research), Big Data/Data Analysis and Cloud Computing in order to optimise processes involved in Healthcare and also make them affordable and scalable compared to the current practices especially in Africa. minoHealth uses Artificial Intelligence to make Health Predictions/Forecasts, Diagnoses and Prognoses(currently in Research phase) and organises and stores Patient Health Records in the cloud with 'Hospital portal' and 'Ministry Portal' for authorised healthcare personnels. All Data collected is intelligently organised with 'Big Data' approaches and technologies, they are continually analysed so important health information/stats on health center patients are visualised and made available to physicians.

At the same time, with the permission of the various health centers, all the health data are also automatically saved and organised within the 'Ministry Portal' which allows for National Health Records Databases. This could also be extended even for the continent. Analysed and visualized health information/stats is a really good source of studying and noting early patterns of outbreaks nationally or continentally, so they can be managed before escalation.

Collected data is used to further train and develop more Artificial Intelligence Healthcare models and systems.

Use Cases, User Stories and Activities

Healthcare Personnel

- Store Patient Health Records
- Access Patient Records (via Mobile Devices and any other Computing Devices)
- Update Patient Records and Have them Have Immediate Effect Over The System
- Observe Charts on Patient Vital Signs Progressions
- Diagnose Medical Conditions with Intelligent Automated systems
- Forecast Patient Health Status with Intelligent Automated systems
- Make Evidence based Prognosis for Patients with Artificial Intelligence
- Observe Analysis, Visualizations and Patterns on Populations of Health Center
- Forecast and Detect Outbreaks Before they Escalate

Authorised Ministry of Health Personnel

- Access Patient Records of Citizens
- Observe Analysis, Visualizations and Patterns on Populations of Countries and even Continents
- Forecast and Detect Outbreaks Before they Escalate

Authorised Patient

- Access Limited Aspect of Your Health Records
- Observe Charts on Your Vital Signs Progressions
- View Test Results

Digital Health Technologies

The main multifaceted system currently has three Artificial Intelligence systems, first one being A.I Female Diabetes Prediction/Forecast system which is a Multilayer Perceptron Neural Network that predicts the probability of a female developing Diabetes in the next 5 years, the model is trained on the "Pima Indians Diabetes Data Set" from the National Institute of Diabetes and Digestive and Kidney Diseases. The other two AI systems are the A.I Breast Cancer Diagnostics systems, one uses gradings on a breast tumor from a pathologist and the other uses nuclei measurements of a breast tumor cell. They both diagnose and classify a breast tumor as benign or malignant. Their both Multilayer Perceptron Neural Networks trained on "Breast Cancer Wisconsin (Original) Data Set" and "Wisconsin Diagnostic Breast Cancer (WDBC) Dataset", respectively, both datasets were put together by Dr. WIlliam H. Wolberg (physician), University of Wisconsin Hospitals, Madison, Wisconsin, USA. (Some screenshots of the system is attached to this Application, names starting with "screenshot - ")
However, we're now more interested in collecting our own datasets that should be extremely large enough to train even more optimal models, and that's exactly what we're doing with minoHealth AI Labs.

minoHealth AI Labs explores in depth how Artificial Intelligence can be used in Healthcare, the Medical Sciences and related fields. Its objective is to research the best ways Artificial Intelligence can be used to save and improve lives. Launched just a couple of weeks go(as of this writing), it has already managed to be involved in about 6 research projects that cuts across various fields. In a complete and recently published research project, minoHealth and a University of Ghana collaborator researched using Machine Learning(Artificial Intelligence) to estimate True Food Consumption for Nutrition/Dietetics (Darlington A. Akogo & Joseph B Danquah, 2018) (attached as: 'FoodEstNet-Estimating True Food Consumption with Machine Learning'). We're also in the very early phase of a research that applies Artificial Intelligence to Optometry and Visual Science, it entails using Convolutional Neural Networks(Artificial Intelligence) to Diagnose Glaucoma, we've collaborated with Dr. David Ben Kumah and Dr. Richard Atakora Baafi of Kwame Nkrumah University of Science and Technology for this research. minoHealth AI Labs and minoHealth Research is also working on a 3 interlinked research projects that combines Artificial Intelligence and Biotechnology, we're researching the use of Convolutional Neural Networks(Artificial Intelligence) to evaluate both biocompatible, polymer-based, nano-fiber scaffolds used in regenerative medical research. One of the research focuses on using Artificial Intelligence to differentiate between nanofiber scaffolds, and the other focuses on using AI to evaluate the quality of nanofiber scaffolds. The third research project(which in itself, has 3 parts) focuses on using AI to diagnose 3D printed cells, tissues and eventually organoids (attached as: 'Artificial Intelligence x Biotechnology'). minoHealth AI Labs and minoHealth Research is also in the early phase of looking for the right Epidemiologists and Public Health personnels to partner with to work on 'Using Artificial Intelligence to Forecast and Detect Outbreaks' (attached as: 'Using Artificial Intelligence to Forecast and Detect Outbreaks'). This also connected to our Data Analytics systems, this research would help add models that focus on observing the most statistically significant features within Health centers to be able to forecast and detect outbreaks before they escalate.

The goal is to seamlessly turn research works into finalised complete systems that'd be added to our multifaceted system and deployed to automate and optimise healthcare and democratise it for all. The futuristic vision is, by 2037, we are able to research and combine Artificial Intelligence, Biotechnology and Nanotechnology, we intend to develop Nanobots that'd use Artificial Intelligence to run Medical Forecasts, Diagnoses and Prognoses within your body and use Biotechnology to administer the right medications all in real time. We're basically looking to create instant advanced Healthcare on the go for all. It's quite a huge moonshot idea but we're already on track in the early phase and with this grant, we're sure to get even closer to that futuristic vision.

Community Feedback

We intend to hold private and public conferences and gatherings where we invite various people within digital healthcare community in order to discuss new expectations the community has of us. We plan to do this at least once every quarter. We also avail ourselves to direct contact via calls, emails and in person meetings. We welcome feedback on our Architecture/Design and all other things.

A self-assessment on the Global Good Maturity Model

(Link: https://docs.google.com/spreadsheets/d/1Zg-V2jw7NHUTa3QUHzEXeaVM2drwvsbhTUnPvV8f8Z8/edit?usp=sharing)

Workplan, Project Deliverables & Schedule

Attached files as: 'GANTT Chart - minoHealth' and 'RACI Charts - minoHealth'

Budget Narrative

Salary

Darlington A. Akogo (Executive Director, Machine Learning Engineer, Data Analyst, Head Of Design): 50 hrs per week to ensure Project success. Currently oversees all general components of Project from Logistics, Artificial Intelligence Research, Data Analysis, User Interface/User Experience Design, Marketing to System Developments.

Xavier Lewis Palmer (Biotechnologist, Biotechnology Researcher, Healthcare/Medical Science Advisor): spends on average 30 hrs per week. Advises on Optimal Medical Science Related Practices to include in systems, Researches ways we could implement Biotechnology to be deployed in Africa and How Biotechnology could be combined and Optimised with Artificial Intelligence.

Michael Addo (Operational Assistant): Works on average 30 hrs per week. Currently assists with daily business operations that keep the project alive.

Vincent Appiah (Machine Learning Intern): Works on average 20 hrs per week. Works on Artificial Intelligence systems and Research.

Frontend Developers(2): (Full Time). Would be responsible for optimal and quick frontend implementations of ideas and research works.

Backend Developers(3): (Full Time). Would implement the core backends of new ideas and research works.

Frontend Designers(2): (Full Time). Would alleviate some workload off of Darlington A. Akogo by handling detailed User Interface/User

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Experience Design /implementation.

Data Scientists(2): (Full Time). Would implement more Data Analysis systems and assist AI/ML team in statistical modelling.

Machine Learning Engineers & Researchers(4): (Full Time). Would join minoHealth AI Labs to work on AI and AI Application Research and assist in implementing such models into the main systems.

Chief Operating Officer: (Full Time). Ensure all operational processes are running efficiently and are optimal. Alleviates Darlington A. Akogo from some logistic tasks, so he can focus more on Engineering and Design.

Chief Financial Officer: (Full Time). Would work on budgets and ensure we run frugally.

Marketing Director: (Full Time). Would lead brand management and marketing communication(including advertising, promotions and public relations).

Travel

The team is expected to travel within the continent(Africa), its various cities, towns and villages and beyond the continent in order to deploy our systems, give presentations and talks about our systems and learn ways we can optimise the systems.

Equipment Purchases

- Nvidia GPU equipped laptops and External GPU boxes for developing and training large Neural Networks(Artificial Intelligence).
- Large Cloud Storages and Solid State Drives to house our systems.
- 3D Bioprinter

- Printers and Scanners

Medical Supplies and Expense

4 First Aid kits and Internal systems for Emergencies and Injuries,

Cost Of Space

- Rent
- Utilities
- Repair/Maintenance
- Janitorial Supplies
- Liability/Property Insurance
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Others

Phone & Internet Services: This is needed to stay in touch with our users and have fast and stable access to our cloud storages.

Meeting Supplies: to provide supplies for administrative meetings and workshops

Office Supplies: including binders, file folders, printer sheets, toner, staples etc

Printing: includes flyers, handouts, conference invites & informations, binding

Advertising: includes Billboards, Hiring notices, meetings, special events

Total: $250,000.00

Supporting Documents:

- screenshot - Breast Cancer Diagnostics
- screenshot - Diabetes Forecast
- screenshot - Medical History
- screenshot - Patient Records
- screenshot - Vital Signs
- Using Artificial Intelligence to Forecast and Detect Outbreaks
- Artificial Intelligence x Biotechnology
- GANTT Chart - minoHealth
- RACI Charts - minoHealth
- FoodEstNet- Estimating True Food Consumption with Machine Learning