Accessible Screening for Preeclampsia

Team

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Scope/Topic: Health

SDGs Impacted

The Challenge

What is Preeclampsia?

Preeclampsia is a condition associated with continuous high blood pressure levels that affects women during or after pregnancy. The condition typically starts around twenty weeks into pregnancy and, if left undiagnosed, can lead to fatal complications including stroke, seizures, and organ failure in both the mother and the baby.

Symptoms and Risks

- Shortness of breath
- Persistent nausea
- Severe headaches
- Protein in urine
- Swelling in legs
- Temporary vision loss
- Fluid in lungs
- Low platelet count in blood

Many of these symptoms are very common, making preeclampsia hard to identify.

Situational Context

In the United States alone, preeclampsia affects 1 in 25 pregnancies. Nearly 500,000 babies die due to the condition each year. It is also estimated that 10-15% of maternal deaths are a result of preeclampsia complications.

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SDG Alignment

Given the high mortality rate associated with preeclampsia, the condition puts the health and well-being of affected women at significant risk. With a lack of access to technology for testing for this, there is also a sense of gender inequality as women aren't able to get testing for certain health problems. There is also a disparity between countries that do and don't have access to reproductive health testing at an affordable cost.

Our Solution

Proposed Action

In order to reduce the number of fatalities caused by preeclampsia during pregnancy, we aim to build a more accurate diagnostic system that only requires data from a basic medical examination.

Current Efforts

Although there have been attempts in the past to use various machine learning models for preeclampsia identification, underlying issues in the choice of models and features have limited their generalizability on real-world data. To avoid such issues, we use a random forest (RF) model to determine the likelihood of preeclampsia symptoms from features such as maternal demographics and characteristics, maternal medical history, present medical condition and complications, laboratory data, and nutrition.

Relying on an RF-based algorithm will also allow us to present clinicians with an analysis of explainability metrics that clearly outline which feature thresholds most impacted the final decision of the algorithm.

Benefits

We envision this tool augmenting the observations of clinicians by providing an objective analysis of the patient's medical data. Since the features we are considering are non-invasive and commonly collected during basic medical check-ups for pregnancy, it will also assist in identifying signs of preeclampsia in regions where access to more extensive screenings is limited.

SDG Advancements

Ensure healthy lives and promote well-being for all at all ages

Indicator: Reduce global maternal mortality ratio to less than 70 per 100,000 live births

By implementing a way to test for preeclampsia, we can help reduce the maternal mortality rate in many different countries that struggle with it.

Achieve gender equality and empower all women and girls

Indicator: Ensure universal access to sexual/reproductive health and reproductive rights

By making the testing with data from medical exams, it help ensure that the tests can be provided universally.

Reduce inequality within and among countries

Indicator: Implement special and differential treatment for developing countries

With basic testing, it helps lower the costs of the examination, therefore allowing it to be accessible to those in developing countries to be able to afford.

Implementation

Feasibility
We plan to first roll out our product to hospitals in the US and then associate with medical volunteer organizations that can bring it to medical centers in developing nations where access to more sophisticated pregnancy screenings is limited. We will use the number of preeclampsia cases correctly diagnosed by the tool as our metric of impact.

Timeline
It will take approximately five months to complete the development phase of the solution, which would include building both the underlying machine learning diagnostic model and the user-facing web application. Another three months would be spent reaching out to hospitals and validating model results. After this stage, we will continue working on increasing the accuracy of our algorithm while reaching out to organizations that would be able to expand the reach of the tool to other regions of the world.

Resources
Computational power is one resource would support the tool's performance. Given the large number of features our model is considering, a more powerful CPU would be required to ensure that predictions can be made within a reasonable amount of time. Machine learning engineers and web developers are another key resource that would accelerate the development timeline for the tool.

Partnerships
We plan to partner with hospitals and organizations such as the Preeclampsia Foundation that are dedicated to fighting the condition in order to test our solution in a real-world setting. Based on these validation experiments, we will be able to make improvements to the core model that would increase its overall precision and efficiency.

Obstacles
The lack of publicly available data is one obstacle that may initially limit the accuracy of the diagnostic tool. However, by establishing hospital partnerships, we can collect more extensive and updated data to increase prediction reliability.

Conclusion

Preeclampsia is a deadly condition that affects a significant number of pregnant women around the world each year. However, with the help of our diagnostic tool, doctors will be able to identify signs of the disease from an early stage and treat its symptoms before they become life-threatening.

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