Using Artificial Intelligence to Evaluate Newborn Health

The placenta develops inside the uterus during pregnancy to provide oxygen and nutrients to a developing baby. The placenta can help diagnose a baby's health in the uterus and start to assess the potential intervention on health problems. The minutes and hours immediately after childbirth are critical for the health of both baby and mother. After a newborn is delivered, the placenta typically follows in the next 5 to 30 minutes. The evaluation of the placenta is usually less common and often completely unavailable. Furthermore, even when a placenta is evaluated, results may not be available for days, missing a critical window for potential intervention.

Researchers at Penn State are working to develop and distribute software that could evaluate a placenta using only a picture taken with a smartphone or tablet. Other development could include expanding the software's classification power so more pathologies can be identified.

Alison Gernand, associate professor of nutritional sciences at Penn State, studies micronutrients and the impact on the placenta and pregnancy outcomes. Her collaborator James Wang, distinguished professor of computer science and engineering, is working on the software.

“Using the software could provide valuable information about the health of the child and mother, but placentas are not commonly examined. Researchers at Penn State are working to develop and distribute software that could evaluate a placenta using only a picture taken with a smartphone or tablet,” Gernand says. “We can provide all the necessary information about the placenta in a few minutes, which would be very helpful in the decision-making process.”

The software needs to be trained to identify a variety of placental pathologies. The researchers have demonstrated that their software can identify chorioamnionitis, an infection of the placenta, which is still a significant pulmonary problem in the United States. In nations with developing economies where there are fewer pathologists per capita, using automated software to diagnose diseases could provide a valuable intervention on health problems.

“Technology could be a powerful component in the physician's ability to assess the health of the placenta for the health of the baby. It could provide good information about any placenta, anywhere,” says Dr. JeWery Goldstein, director of perinatal pathology at Northwestern Memorial Hospital. “We are currently extending the capacity of the comprehensive dataset collected over the years by our research partners at the University of Pennsylvania.”

Next steps for the researchers include expanding the software to evaluate additional problems—including abnormalities of blood vessels—and to determine the reliability of the software so that it can reliably handle the diverse imaging infrastructure and lighting conditions.

“Developing and refining the software is the greatest scientific hurdle that Gernand and I have to overcome,” Wang says. “We have completed the proof of concept and have shown that this will work. The problems we are tackling are highly challenging and have a high potential societal impact.”

The work would not have been possible without the close interdisciplinary collaboration between the clinical and artificial intelligence research teams, Wang says. “Penn State has created an environment that encourages tackling large challenges through such collaborations. As artificial intelligence begins to change the landscape of medicine, the collaboration between professionals in health sciences and computer science is essential.”

“The effort to develop the software could open up new possibilities in the realm of medical practice,” Goldstein says. “It could save a lot of lives.”

“Whether we use traditional approaches or artificial intelligence, we just need funding to put this all together,” says Gernand. "We really need it. It could save a lot of lives.”

NOTE: This section contains images of human placentas. Each image depicts a different medical condition that the software detects. In some cases, the condition could be potentially dangerous or deadly for the mother and/or baby. Use of the software could provide valuable information about the health of the child and mother, but placentas are not commonly examined.