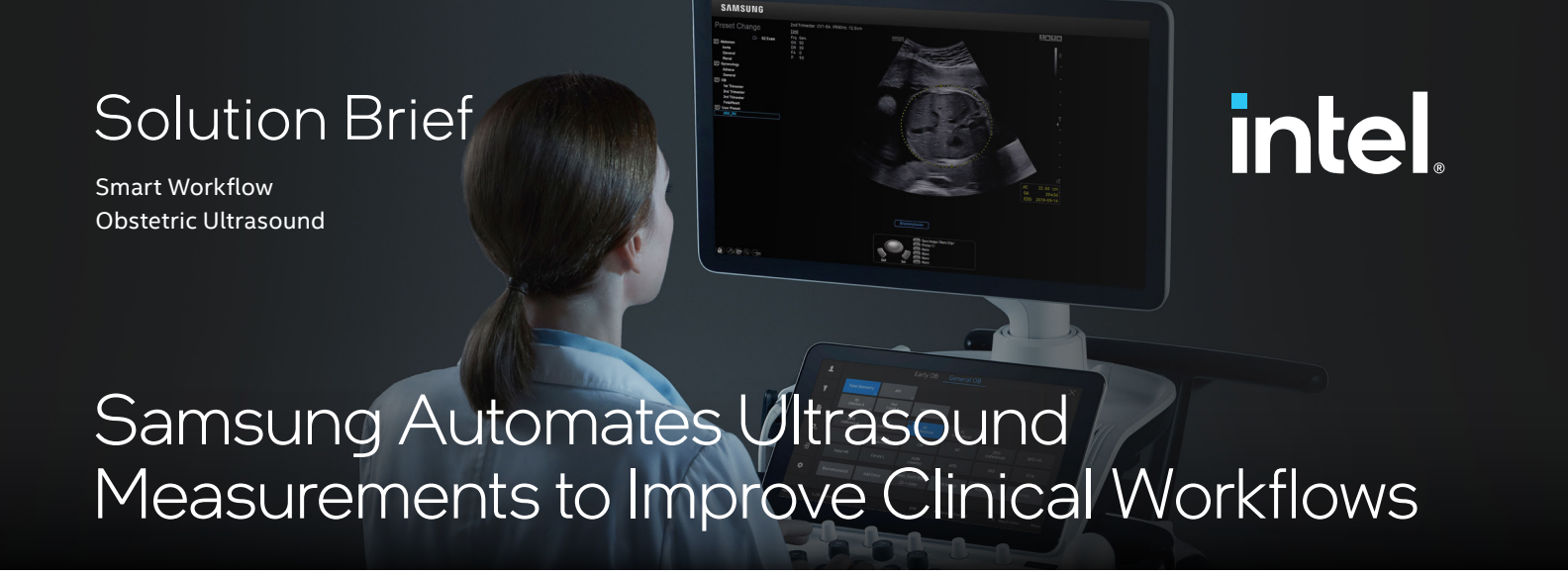


Solution Brief

Smart Workflow
Obstetric Ultrasound

Samsung Automates Ultrasound Measurements to Improve Clinical Workflows

Streamlined fetal and maternal measurements optimized by the Intel® Distribution of OpenVINO™ toolkit

SAMSUNG MEDISON

"New or innovative technologies are not always the solution for diagnosing novel diseases. The automation of diagnostic features developed through collaboration between Samsung and Intel is a great example. Samsung is working to improve the efficiency of new diagnostic features, as well as healthcare services, and the Intel® Distribution of OpenVINO™ toolkit has been a great ally in reaching these goals."

—Won-Chul Bang, Corporate VP, Head of Product Strategy Team, Samsung Medison

Obstetric ultrasound requires taking measurements with a high degree of accuracy to engage in data-driven decision-making for maternal and fetal patient safety. However, the process of obtaining those measurements has generally been a tedious clinical task, prone to intraobserver variation. Now, Samsung Medison has developed two automated ultrasound measurement technologies to inform clinical decisions during pregnancy and birth.

Samsung's upgraded **BiometryAssist™** feature automates and simplifies the process of taking fetal measurements during prenatal ultrasound scans with over 97 percent accuracy[1] while its new **LaborAssist™** technology automatically estimates the fetal angle of progression (AoP) during labor for a better understanding of fetal descent and progress without the need for invasive digital vaginal examinations.

Benefits of Samsung Medison BiometryAssist™ and LaborAssist™ automatic ultrasound measurement include:

- **Accurate, fast measurement:** Both the BiometryAssist and LaborAssist features offer accurate measurements quickly to verify measurements for high volumes of patients.
- **Streamlined clinical workflows:** Single-button measurement enables a less obtrusive and tedious clinical workflow during ultrasound examinations, as compared to typical caliper-style measurements.
- **Improved clinician/patient communication:** Visualization tools in LaborAssist make it easier for patients to understand what the AoP means for labor progress and fetal descent, helping clinicians communicate the need for selecting a birth method.
- **Fewer invasive clinical exams:** Using LaborAssist for transperineal ultrasound allows a reduction in manual examinations, which carry a risk of infection and are found uncomfortable and invasive by laboring mothers.

Challenges: Analyzing complex ultrasound images including fetal positioning and cartilage location

Clinicians are often expected to perform a large number of fetal ultrasounds per day, and many of these ultrasounds present significant challenges to accurate biometry. Because clinicians must repeat the same exams frequently, repetition and fatigue can lead to intraobserver variance in fetal biometry.

Obtaining head circumference (HC) and abdominal circumference (AC) measurements is necessary to assess proper fetal growth, but for images obstructed by the placenta or shadowing, accurate measurements were difficult to obtain with manual techniques or previous attempts at biometric automation. In addition, an overall increase in maternal age has resulted in a greater need for imaging to help

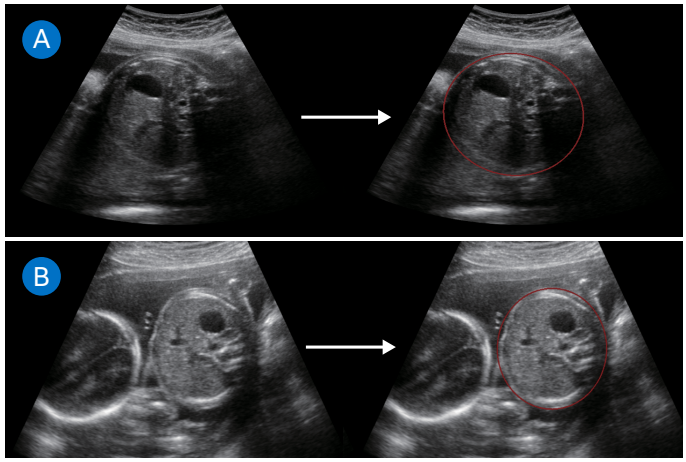
ensure good patient outcomes. But obtaining consistent measurements is difficult, with high variance in accuracy between experienced and new practitioners.

During labor, measuring fetal descent was originally performed with invasive digital examinations. However, automated analysis of the AoP—the angle measurement between the long axis of the pubic symphysis and the tangent line to the fetal skull—offered a more accurate understanding of the speed of labor progression. Accurately determining this angle can also assist in making a clinical determination that a caesarean delivery may be indicated due to lack of progress. Unlike the pelvic bones, the cartilage of the pubic symphysis is not always easily distinguishable from the surrounding tissue, creating a challenge for manual and automated measurement.

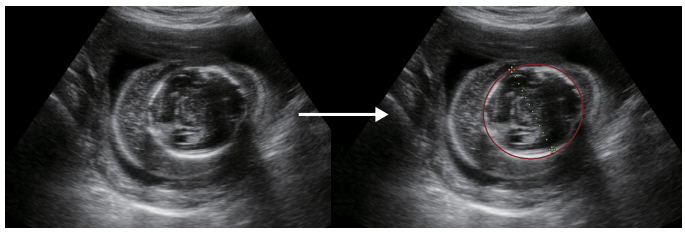
Solution: Accurate, automated measurement for faster, more-consistent ultrasound imaging

In a typical clinical setting, manual biometry of fetal ultrasounds is a time-consuming process, requiring the clinician to press a button to measure each end of the measurement, then validate the measurement by remeasuring. Due to fetal movement and positional changes, these measurements can be difficult to obtain. Using improved algorithm-based **Samsung BiometryAssist**™, optimized with the Intel® Distribution of OpenVINO™ toolkit, semiautomated fetal biometry can obtain a 97 to 99 percent accurate measurement for biparietal diameter (BPD), femur length (FL), head circumference (HC), and abdominal circumference (AC).[1]

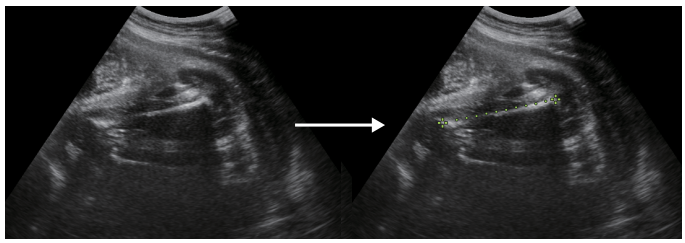
These measurements can be performed with a single button press in as little as half a second, drastically reducing the amount of time spent on biometry during the prenatal exam while helping clinicians maintain consistency without fatigue. Particularly in high-volume clinical environments, this can represent significant time savings and enable more measurements of fetal growth to be taken.



The improved algorithm enabled placement of a caliper around the AC even when the fetal abdomen was abutting the placenta with a moderate amount of shadowing (see **A**), or was next to another round structure such as the fetal head (see **B**).



Successful delineation of BPD and HC in a cystic hygroma fetus at early second trimester. The system was able to discriminate the true cranium from the echogenic skin line around it.



FL is accurately delineated in the presence of shadowing.

LaborAssist™ works by automatically detecting the pubis outline and fetal head outline in cross section, segmenting the outlines for maximum accuracy from a single button touch. Measurements take an average of 1.5 seconds. Images are obtained through an intrapartum transperineal ultrasound scan, which will then be overlaid with the AoP and head direction based on fetal measurements. In a clinical assessment of LaborAssist accuracy, AoP could be determined within ± 8°, a narrower range than reported intraobserver (8°) and interobserver (14°) errors from manual measurements.[1,2]

In addition to measuring ultrasound images, LaborAssist offers several convenient visualization tools that can make it easier for clinicians and patients to understand labor progress. Users can review a full labor history, including the full series of labor images and measurement results in a 3-by-2 layout. Clinicians can also play a demo video animation for patients based on their measured AoP, for an intuitive visual representation of labor progress with more-comprehensible images than an ultrasound cross section.

LaborAssist offers several convenient visualization tools to help understand labor progress.

How it works in brief

To develop these innovative new features, Samsung selected the Intel Distribution of OpenVINO toolkit as a software solution that could run on their existing hardware platform, without requiring modifications or upgrades to existing hardware. The toolkit provided the speed and performance—as well as scalability and strong support—that Samsung's developers needed to quickly create a solution accurate enough for use in clinical settings.

Using machine vision algorithms to analyze ultrasounds, LaborAssist is capable of measuring the AoP to within 8° with 95 percent confidence.[1] This is superior to human observation, where intraobserver variance has been measured at 14° at a 95 percent confidence interval.[2]

Powered by an Intel® Core™ i3 processor and accelerated using the Intel Distribution of OpenVINO toolkit, inference was sped up by 4.7x for BiometryAssist and LaborAssist, compared to inferencing without optimizations.[1] This result was achieved through close collaboration between Intel and Samsung Medison software engineers.

About Samsung Medison

Samsung Medison, an affiliate of Samsung Electronics, is a global medical equipment company founded in 1985. With a mission to bring health and well-being to people's lives, the company manufactures diagnostic ultrasound systems around the world across various medical fields.

samsunghealthcare.com

Conclusion: Fast, accurate obstetric ultrasound measurement powered by Intel® technology

Clinicians today must perform a large number of ultrasound examinations, both before and during labor. Obtaining measurements manually based on ultrasound images is an error-prone process, with accuracy contingent on provider experience and fatigue levels. To streamline these measurement workflows, Samsung Medison created BiometryAssist for automated biometry during prenatal ultrasound exams and LaborAssist for automated measurement of the AoP and assessment of fetal descent during labor.

With Intel® processors and the Intel Distribution of OpenVINO toolkit, BiometryAssist and LaborAssist offer near-instantaneous measurements based on fetal and maternal imaging. Using a simple single-step workflow, these features offer consistent measurements, without the need for clinicians to repeat manual measurements many times throughout the day. BiometryAssist and LaborAssist help clinicians to better understand and assess patient needs faster, with fewer invasive exams and a high degree of clinical accuracy.

Learn more

Intel and Samsung Medison have agreed to collaborate on developing several new ultrasound technologies as well as a future ultrasound platform. To discover how BiometryAssist and LaborAssist can streamline clinician workflows and improve patient experience during pregnancy and birth, download the **white paper** or **report**.

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1. Source: Internal Samsung testing.
System configuration: Intel® Core™ i3-4100Q CPU @ 2.4 GHz, 8 GB memory; OS: 64-bit Windows 10.
Inference time *without* OpenVINO enhancements was 480 milliseconds. Inference time *with* OpenVINO enhancements was 85 milliseconds.

2. Source: https://www.ncbi.nlm.nih.gov/pubmed/21083864.

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