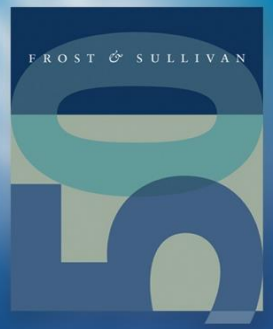
Advances in Clinical Workflow Automation, GI Imaging, Machine Learning Solution for Stroke Treatment, High-Frequency Ultrasound, AI-enabled Diagnostic Imaging--Medical and Diagnostic Imaging TechVision Opportunity Engine

TechVision Group of Frost & Sullivan



D861-TV

September 29, 2017

FROST & SULLIVAN

Contents

Technology Innovations in the Medical & Diagnostic Imaging Industry

AI-based Solution for Automating Clinical Workflow

VoxelCloud, US

Challenges/Needs

The need for automation of clinical workflow reducing manual interpretation of images has been largely felt across various medical practices, especially clinical radiology and pathology. The demand for such solution is higher in potential emerging markets hosting very high population of patients, especially India and China.

Innovation Attributes

VoxelCloud combines artificial intelligence with cloud computing and machine learning to improve efficiency in report interpretation.

Data-driven algorithms help diagnose pulmonary disorders, liquid biopsy imaging solution in early cancer screening, and assessment of coronary artery disease.

Cloud computing platform enables smooth in-browser image visualization and quantification, ensuring seamless integration with the clinical workflow with evidence-based clinical action.

VoxelCloud is compatible with various medical images, such as computed tomography, ultrasound, X-rays and digital color imaging of the retina.

Technology Profile

Who & What?

California-based, VoxelCloud is pioneering the development of a artificial intelligence based solution that bridges the supply-demand imbalance of medical professionals during diagnostic process. The solution is designed to augment medical professionals with insights from patient's medical images in a concise and easily digestible format.

Customer Segments

- Oncologists
- Pulmonologists
- Diabetes Specialists
- Cardiovascular Surgeons
- Clinical Radiologists
- Digital Pathologists

Key Value Proposition

Making use of medical images, data-driven analytics, proprietary machine learning algorithms, validation of real-world training data for medical professionals, in-browser image visualization and quantification.

Major Milestones & Future Plans

VoxelCloud is currently in use at medical facilities in Suzhou and Shanghai in China, where it is used for lung cancer diagnosis, and for the study of retinal diseases and coronary heart disease. The company is expecting formal approval from Chinese Food and Drug Administration by end of 2017.

Quadripolar CRT Leads for use with 1.5T and 3T MRI Systems

Medtronic plc, Ireland

Problem Statements

Heart failure is a major public health problem, with a prevalence of over 5.7 million in the U.S., and over 23 million worldwide. Sudden cardiac arrest is responsible for 60 percent of deaths among heart failure patients. Cardiac resynchronization therapy (CRT) is treatment option for heart failure in which in implantable device sends low levels of energy through leads, to stimulate heart muscle and improve heart's pumping efficiency. Left Ventricular (LV) lead positioning and stability remain a challenge for physicians as acute and chronic lead dislodgement are concerns. The successful achievement of a stable and effective LV lead position is the pivotal element of effective CRT.

The Attain Stability Quad MRI SureScan cardiac lead is a steroid-eluting, quadripolar electrode, cardiac vein pacing LV lead featuring a side-helix designed to be fixated precisely in veins of various sizes.

This new lead provides another option for LV lead placement designed to meet the needs of patients with various anatomies & improves surgeons flexibility to place the lead where they want to within the vessel.

It is paired with Medtronic quadripolar CRT-defibrillators (CRT-D) and pacemakers (CRT-P) and features novel, active-fixation technology designed for precise lead placement & stability.

This CE Marked lead is approved for 3T and 1.5T MRI scans and the four electrodes (quadripolar technology) allow physicians flexibility in finding the optimal location for stimulating the heart.

Technology Profile

Company Profile

Medtronic plc, is one of the leading medical technology, services and solutions companies worldwide. It offers broad range of solutions for interventional and surgical treatment of cardiovascular disease & cardiac arrhythmias.

Technology Focus

Develop technology targeting the optimal site for LV lead implantation away from myocardial scar and close to the latest LV site activation to maximize the benefit from CRT and reduce the number of non-responders

Current Status of Regulatory Approvals

This product is under evaluation in clinical trial stages in the U.S. and is not approved for sale. In the Europe, where it has recently received CE mark, it has undertaken a limited launch. The first commercial implants were performed at Haukeland University Hospital, Bergen, Norway. Medtronic has recently initiated a clinical trial with 471 patients across 56 sites in the United States, Canada, Europe, Hong Kong and Malaysia to evaluate the safety and effectiveness of the lead in heart failure patients.

Recent News

In August 2017, Medtronic received CE mark for the Attain Stability Quad MRI SureScan left heart lead.

Company Outlook

Medtronic looks forward to receiving positive results from the global clinical study to support approvals in new geographies and reach more patients

Next-generation Gastrointestinal Anatomical and Functional Imaging Product

Crospon, Galway, Ireland

Challenges/Needs

Gastroesophageal reflux disorder (GERD) is a digestive disease that is caused by the chronic regurgitation of the gastric acid up the esophagus. Persistent acid reflux causes the lining of the esophageal wall to undergo cellular modification, resulting in an increased risk of a lethal type of cancer called esophageal adenocarcinoma. The key to the effective and early diagnosis of these diseases is a functional assessment of the GI tract.

Innovation Attributes

The underlying principle of EndoFLIP is the inverse relation between the voltage across the electrodes and the square of the esophagus diameter. For instance, the device measures the degree of elasticity of the gastroesophageal junction, the tautness of fundoplication wraps, compliance of the smooth muscles lining the GI tract and so on. EndoFLIP system can be used to measure virtually any hollow organ, vessel or sphincter, provided, the current applied is constant and the properties of the medium are known.

EndoFLIP's core strength lies in measuring the diameter and cross-sectional area of the esophagus, and indirectly assessing its muscle strength and elasticity. In addition to enhancing the current features of EndoFLIP and expanding its applications, Crospon is also actively working pairing EndoFLIP with conventional endoscopy procedures. This would enable dynamic imaging of the esophagus, by bridging the gold standard imaging approach of endoscopy with EndoFLIP's novel functional measurement.

Technology and Innovator Profile

Crospon, has developed Endolumenal Functional Lumen Imaging Probe (EndoFLIP), an imaging solution for the functional assessment of the GI tract. It is a catheter-based system that measures the physical and functional performance at multiple points along the esophagus. The catheter measures parameters such as esophageal diameter, pressure, cross-sectional area, volume, and so on, and makes it possible to determine the distensibility, elasticity and compliance of vessels and sphincters.

Key Value Proposition

Some of the measurements that EndoFLIP can record were so far possible only through expensive procedures such as computed tomography (CT) imaging or radiological imaging after a Barium-swallow. device is best-suited for upper GI imaging, assessing the elasticity of the GEJ, measuring the size of the esophageal lumen, assisting in the selection of the appropriate dilation balloons, stents, and in planning for bariatric and GI surgeries.

Major Milestones

In May 2017, EndoFLIP earned FDA clearance for its second-generation imaging software that provides an internal view of gastro esophageal junction.

Applications

The latest FDA clearance makes it well-suited to diagnose a condition that causes the sphincter to remain closed during swallowing. EndoFLIP is also cleared to image spastic motility disorders.

Innovative Brain Blood Flow Monitoring Device

Neural Analytics, CA, US

Challenges/Needs

- Traumatic brain injury (TBI) and stroke often result in severe physical, cognitive, social, and emotional changes in the human body and are some of the leading causes of death worldwide.
- The most prominent diagnostic technique is a neurological examination to determine the condition's diagnosis, prognosis, and management. Similarly, radiological tests such as computerized tomography (CT) can be performed, and magnetic resonance imaging (MRI) can support information on long-term complications as well. However, many of these examinations cannot be successfully performed in emergency procedures because of their relative inefficacy in detecting bleeds. Moreover, these imaging modalities are immobile, thus making them unavailable in operating rooms and emergency services.

Technology Profile

Who & What

- Neural Analytics has commercially launched its Lucid™ M1 Transcranial Doppler Ultrasound System (Lucid system) as an effective brain blood flow monitoring instrument that can ease the lives of millions of people worldwide who are suffering with TBI and stroke and save billions of dollars spent by the US Government every year toward treatment costs.
- The device consists of a headset comprising a Transcranial Doppler (TCD) scanner that automatically locates various cerebral arteries by exerting a suitable yet significant amount of pressure on the head to acquire good cerebral blood flow velocity (CBFV) signals. The headset wirelessly communicates with the portable tablet device and displays the monitoring signals received from the headset.

Innovation Attributes

The Lucid system is a non-invasive, all-in-one, portable ultrasound system diagnosing TBI or stroke at the physician's office, eliminating the need for additional invasive diagnostic tests.

Lucid system can generate a blood flow score in under 5 minutes that can alarm the clinician of a developing risk such as a concussion.

Market Potential

The Lucid system was cleared by the US Food and Drug Administration (FDA) in November 2016 and received the CE mark in January 2017.

The company raised funding of over $26 million in the past 5 years, with its latest round of funding of $10 million in April 2017.

It has also received R&D grants from the National Science Foundation and National Institutes of Health.

Advanced Machine Learning Solution for Treating Stroke Victims

Viz, US

Challenges/Needs

Statistics from the American Stroke Association prove stroke to be the fourth leading cause of death in the US, which is also one of the diseases difficult to diagnose. Lack of experienced neurologists that can aid early diagnosis of stroke victims is a critical need across many countries, especially in the US.

Innovation Attributes

Machine learning algorithms are applied to medical imaging data sets to identify anomalies in brain scans, which are more likely missed by trained neurologists.

Viz is designed to scan thousands of medical images over a period of few milliseconds, deriving instantaneous patterns on the abnormalities.

Viz is clinical evaluated for efficiency in diagnosing complex data sets, and has been demonstrated to considerably reduce diagnostic errors.

Deep learning algorithms incorporated within Viz bridges the average standard of care to the best standard of care by delivering timely diagnosis to patients.

Technology Profile

Who & What?

Viz, a San Francisco-based startup has developed an advanced stroke diagnostic solution that fuses artificial intelligence and medical imaging to aid doctors in rapid identification of stroke victims, ensuring faster treatment and reasonable cost savings. The solution is designed to process huge volumes of medical images within a few milliseconds augmenting existing diagnostic modalities that are most relied in taking timely treatment decisions for stroke victims.

Customer Segments

- Stroke Specialists
- Neurologists
- Stroke Rehabilitation Centers
- Multi-Specialty Hospitals
- Private Diagnostic Centers

Key Value Proposition

Deep learning algorithms, work across geographies to facilitate efficient care, Aids reference to the right specialists, Processing huge volumes of medical image data within milliseconds.

Major Milestones & Future Plans

Viz recently closed a $7.5 million seed funding from leading investors such as DHVC (Danhua Capital), Innovation Endeavors and AME Cloud Ventures. Efforts are underway to accelerate product development and to commence clinical testing of Viz across leading stroke therapy centers in the US.

Small, Portable, Vein Viewing Imaging Device

AccuVein Inc., NY, US

Challenges/Needs

Doctors performing venipuncture procedures are often unable to find the right vein during administration of intravenous therapies or for sampling of venous blood, leading to a lot of hassle for doctors and unnecessary trauma for patients.

Innovation Attributes

1

AccuVein AV400 can be used on a variety of patient with different body types and skin tones.

2

AccuVein can be attached to a chair or bedrail for hands-free use. This non-contact imaging device may not require sterilization between uses..

3

The device has center line accuracy to the width of a human hair and can detect veins up to 10 mm deep.

4

This AccuVein device can locate veins both in light or dark lighting conditions.

Technology Profile

Who & What

- Understanding the basic challenge, AccuVein Inc., has developed a small, portable imaging device called AccuVein AV400 vein viewing system.
- This device when held in any direction, seven inches above the skin, clearly displays the vasculature on the skin surface.
- This device is extremely useful for nurses, saving valuable time. This device causes less discomfort for the patients, and results in higher patient satisfaction.

Clinical Evidence

- AccuVein AV400 vein viewing system causes 39% reduction in pain in patients.
- It improves the success of first stick venipuncture by 3.5 times.
- The use of AccuVein device causes 45% decrease in escalation calls causing annual savings of $352,498 to the healthcare systems.

High-frequency Ultrasound for Glaucoma Treatment

EyeTech Care, Lyon, France

Challenges/Needs

The International Glaucoma Association estimates that more than 50 million people are living with glaucoma, 12 million of whom are in Europe. China, India and other Asian countries have millions of people who have been diagnosed with glaucoma, and millions more undiagnosed. WHO has listed glaucoma as a priority eye disease, given that it is the second leading cause of blindness in the world.

Innovation Attributes

EyeTech Care's flagship product, EyeOP1, consists of a computer console to control the dosage and time, and an ultrasound probe that consists of six piezoelectric transducers, arranged in a circular array. The circular array and the probe design ensures that HIFU is effectively deliver the dosage to the ciliary gland in less than three minutes. The computer console also makes the therapy completely computer-guided, the first of its kind in the market. This also removes errors due to lack of skilled technicians working the device.

EyeOP1's UCP technology is believed to two effects on the intraocular pressure of the eye, which causes glaucoma. First, UCP targets the ciliary glands to control the production of aqueous humor, an excess of which can increase the pressure. Second, UCP is also believed to open up additional drainage pathways, which is another way of keeping the IOP under control. Among the the numerous patient benefits that EyeOP1™ offers: it is a non-invasive, pain-free, medication-free and quick alternative to both surgery and medications.

Technology and Innovator Profile

Eye Tech Care has developed a non-invasive glaucoma therapy using high-intensity focused ultrasound (HIFU); one that uses focused ultrasound waves for therapeutic applications. Usually, HIFU is used in applications such as lithotripsy, tissue ablation to treat prostate and breast cancers and uterine fibroids. Eye Tech Care's Ultrasound Ciliary Plasty (UCP) is currently the only HIFU-based medical procedure that has been approved for the treatment of glaucoma.

Key Value Proposition

EyeOP1 is currently the only computer-assisted glaucoma therapy in the market, and it is cleared to treat refractory glaucoma, or glaucoma that remains uncontrolled even after medications and surgery. Due to low awareness and poor medication compliance, glaucoma is not detected till late stages. In such cases, medications will be ineffective, and surgery can be expensive, EyeOP1™ may well emerge as the first-in-line treatment option.

Major Milestones

In 2017, EyeTech Care received $29 million from Everpine, a China-based investor. The proceeds will be used the company's international expansion, particularly into China.

Future Plans

The company is waiting for regulatory clearance from the Chinese Food and Drug Administration, which it expects by the end of 2017. Other Asian countries are also in EyeTech Care's expansion outlook in the next few years.

Artificial Intelligence-enabled Diagnostic Imaging For Precise Decision Making

MedyMatch Technology Ltd., Israel

Challenges/Needs

- Medical imaging diagnosis is plagued by human error often causing misdiagnosis.
- Research studies have shown that around 30% of all medical imaging diagnoses are incorrect and 80% of those errors are perceptual errors that are not noticed by human eyes.

Industry Collaborations

In March 2017, MedyMatch Technology formed a collaboration with IBM Watson Health to bring MedyMatch's AI-based brain bleed detection application to imaging experts working in hospital emergency rooms and other acute care settings. In the same month, MedyMatch Technology Ltd. and Samsung NeuroLogica Corporation, the healthcare subsidiary of Samsung Electronics Co. Ltd., collaborated to integrate MedyMatch's clinical decision support applications with Samsung NeuroLogica's medical imaging hardware in the acute care setting.

Future Aspects

The company's future aim is to address diagnosis and prognosis challenges of chronic diseases such as neurodegenerative disease, cerebrovascular disease, and PTSD (Post Traumatic Stress Disorder) via AI, deep machine vision, and learning.

Technology Profile

Who & What

- With the aim to improve diagnosis and help physicians make accurate diagnosis and correct decision making, MedyMatch Technology Ltd., has developed an artificial intelligence (AI)-based platform, which provides real-time, patient-specific decision support.
- MedyMatch uses AI, machine learning, and deep learning technologies to leverage 3D medical imaging data, along with electronic medical records and genomic data.
- Accurate decision making in acute medical scenarios improves healthcare outcomes and reduces costs.

Innovation Attributes

- The platform is enabled with acute imaging artificial intelligence.
- It uses deep vision and cognitive analytics to compare and identify any rare abnormalities from billions of data points from imaging and other health record data that are invisible to the human eye.

Industry Contacts

Michael Rosenberg

Chief Financial Officer,
MedyMatch Technology, Ltd.
76 Yigal Alon Street, 5th Floor,
Tel Aviv, Israel 67067
Phone: 8183174999
E-mail: mrosenberg@medymatch.com
URL:https://medymatch.com

Henry Hewes

Global Vice President, Sales and Marketing,
Neural Analytics,
2440 S Sepulveda Blvd.,
Suite 115, Los Angeles, CA, 90064.
E-mail: henry@neuralanalytics.com
Phone: +1-949-239-2018
URL: http://www.neuralanalytics.com/

Ron Goldman

CEO,
AccuVein Inc.,
P.O. Box 1303, Huntington, NY 11743.
Phone: +1-816-997-9400
E-mail: info@accuvein.com
URL: https://www.accuvein.com/

Xiaowei Ding

CEO,
VoxelCloud,
505 N Figueroa St Los Angeles, CA 90012.
Phone: +1-310-890-9480
E-mail: xding@voxelcloud.io
URL: www.voxelcloud.io

Industry Contacts (continued)

Dietrich Wolf, Ph.D

Chief Executive Officer,

EyeTech Care SA

2871 Avenue de l'Europe, 69140 Rillieux-la-Pape,

Lyon, France

Phone: + (33) 6 7001 8102

E-mail: dwolf@eyetechcare.com

URL: www.eyetechcare.com

Jon O'Dea

Chief Executive Officer,

Crospon, Ltd.

Galway Business Park,

Dangan, H91 P2DK, Galway, Ireland

E-mail: jodea@crospon.com

Phone: +353-91-519880

URL: http://www.crospon.com

Joe Hanley

Vice President, EMEA Communications,

Medtronic, Inc.

Swords Business Campus, Balheary Rd, Balheary Demesne, Swords, Co. Dublin, Ireland

Phone: +353 1 511 1400

E-mail: joseph.hanley@medtronic.com

URL: www.medtronic.com

Chris Mansi

CEO,

Viz,

343 Texas Street, San Francisco 94107,

Phone: +1-650-521-7127

E-mail: chris@viz.ai

URL: www.viz.ai