

ASX ANNOUNCEMENT

28 October 2015

Capitol Secures Enlitic partnership to deliver better Patient Outcomes

The Directors of Capitol Health Limited (ASX:CAJ, "Capitol") are pleased to advise that the Company has entered into a Memorandum of Understanding (MoU) with Enlitic LLC to commercialise Enlitic's deep learning and Artificial Intelligence (AI) protocols in radiology and healthcare. The agreement delivers Capitol exclusive use of Enlitic in Australia and provides for collaboration on international deployment. Enlitic's mission is to provide the tools that allow physicians to make better informed patient decisions by fully utilizing the vast stores of medical data collected; including medical images, doctors' notes, and structured lab tests. Enlitic's data-driven tools will assist in making Capitol's radiology diagnostics faster, more accurate, and more accessible.

Highlights include:

- First mover in data-driven revolution in healthcare
- Healthcare is the world's largest industry – valued at USD\$8 trillion, diagnostics represents USD\$3 trillion
- MIT Technology Review selects Enlitic as one of the world's "50 Smartest Companies 2015"
- Enlitic makes medical diagnostics faster, more accurate, and more accessible
- Capitol to receive Australian/NZ and Asian marketing rights to Enlitic
- Partnership investment by Capitol of up to USD\$10m

Background

Capitol believes healthcare is on the verge of a data-driven revolution powered by the presence of enormous stores of medical data along with recent advances in machine learning. This, for the first time, allows computers to understand images, natural language, and other unstructured data. The quantum of data gathered through lab tests, medical images, and doctors' notes increases on a daily basis. These massive stores of information are collected and processed by Enlitic with the aim of profiling the complex and ever-changing patterns of diseases.

The Technology

Recent advances in AI have integrated the algorithmic analysis of images, natural language, and structured data with problem-solving systems, resulting in breakthroughs such as Google's self-driving car, the Jeopardy victory by IBM's Watson, and the automatic labelling of photos by Apple and Facebook.

The rapid rate of improvement in this area is significant. In 2012, Google achieved state-of-the-art results in image recognition using a cluster of 16,000 computers running in parallel. Since then algorithms have been developed that are 400% more accurate and use only a single PC and GPU, resulting in operating costs of only a few hundred dollars. Systems based on deep learning methods can develop a basic understanding of natural language purely via exposure to books.

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Results

Enlitic has tested the technology on two primary proof-of-concept projects:

- lung nodule/cancer detection and diagnoses, and
- extremity bone fracture detection.

Lung Cancer:

Cancer is the leading cause of death worldwide, accounting for 8.2M deaths, and lung cancer accounts for the largest share of such mortality at 1.59M deaths worldwide.¹ A focus on lung cancer will have significant impact in Asian markets. For example, smoking prevalence in China is >x2 compared to the US (China 49%, US 21%).²

Enlitic's first technical proof-of-concept was to develop automated methods to support early detection of lung cancer, which leads to the best chance of survival. They adapted deep learning technology to ingest 3D lung CTs, automatically detect small lung nodules, and estimate their probability of malignancy. Enlitic benchmarked performance against human performance in the impressive NIH-funded Lung Image Database Consortium research project³. In those tests, Enlitic's algorithm was 50% better than a panel of four human experts at estimating the probability of malignancy. Algorithm accuracy will increase substantially as we access more rich training data. The same underlying technology, through a process known as 'Transfer Learning,' can be applied to other afflictions and imaging modalities (MRI, CT, Digital Mammography, X-Ray, etc.), and detect/classify other types of lesions, abnormalities, and cancers, with little additional work.

Bone Fracture Detection:

The second technical proof-of-concept automatically detects fractures in wrist x-rays. X-rays of the extremities occur in high-volume in urgent care centers, emergency departments, and locations without radiologists such as nursing homes. While they are rarely fatal, a missed fracture can drastically impact a patient's quality of life, especially as errors occurring in paediatrics can impair proper bone growth and alignment for a lifetime.

Enlitic's algorithm detects fractures in wrists and shows a heat map overlay indicating its confidence of fracture presence, at an AUC (Area Under ROC Curve - the most widely used measure of model accuracy) of 0.986. **No other software or academic research has successfully solved this problem** before - standard CAD approaches have an AUC of 0.71, and radiologists themselves have an AUC of 0.85. These tests indicate that, for the first time, it is now possible to reliably and quickly find extremity fractures.

This technology is equally applicable elsewhere in the body, across ankles, toes, noses, hips, collarbones, while enabling radiologists to gain comparable efficiency in report turnaround times.

¹ <http://www.who.int/mediacentre/factsheets/fs297/en/>

² <http://data.worldbank.org/indicator/SH.PRV.SMOK.MA>

³ Armato III, Samuel G et al. "The lung image database consortium (LIDC) and image database resource initiative (IDRI): a completed reference database of lung nodules on CT scans." *Medical physics* 38.2 (2011): 915-931.

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The Opportunity

Partnering with Enlitic will provide Capitol with the following clinical, operational and expansion benefits:

Improving quality and costs of diagnostic care includes:

- Reducing false positive and false negative findings that can lead to unnecessary tissue biopsies, lab testing, patient distress, etc.
- Increasing accurate first-time diagnoses (missing diagnoses and missed diagnoses)
- Reducing overutilization of medical procedures
- Accurate and faster diagnosis should drive increased market share as referrers seek best outcomes first time

Improved productivity of radiologists through:

- Directing interpretation to most clinically relevant images/slices
- Speeding review of images through heat-map prioritization to relevant problem-areas
- Automating the generation of the administrative parts of the medical report, including measurements, comparison with priors, and creation of standardized reporting sentences for the radiologist to select from or confirm.
- Aligns with Capitol's low cost model while maintaining high standards of care

Improved productivity and quality in developing economies, such as Asian markets:

- Assisting radiologists to read more images and generate more radiology reports per capita
- Assisting medical professionals (or even community workers) with less training to handle routine cases
- Widening radiology service coverage, ushering in specialization for the first time to areas with even insufficient general coverage. For example, most x-rays in India are read by nurses, not trained radiologists. In India there is approximately one radiologist for every 100,000 population (compared to US where the corresponding ratio is 1:10,000).⁴
- Bringing advanced technology and protocols to developing economic regions that are increasingly demanding improved care
- Supporting indemnity insurers through Enlitic tools that provide another layer of comfort and assurance in the diagnosis process.

The scope of work covers cancer detection and treatment planning, as well as a wide range of other high impact medical issues - the consistent underlying theme is using a data-driven, time sensitive approach to improving patient outcomes.

Investment

Capitol will invest up to USD\$10m in the Enlitic partnership. It is intended that Capitol will make available to its radiologists a certain percentage of that investment. This enables the radiologists to buy-in not only to the investment but ensure we retain and attract high performing radiologists.

⁴ <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4256238/>

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Capitol Health Managing Director John Conidi commented:

“These are truly exciting times for Capitol, partnering with Enlitic to transform the way we deliver patient care, not only in Australia but globally. This collaboration is a world first, delivering to Capitol radiologists, referrers and patients outstanding clinical outcomes, efficiently. Capitol expects to commence the project with Enlitic in the first quarter of the 2016 calendar year, with a goal of clinical ready processes for identified afflictions by the middle of 2016. It is an ambitious timeline, but our experience with Enlitic and the capability of our team of radiologists make these goals possible. At Capitol it’s always about improving patient outcomes, because that invariably drives financial success through increased market share and revenue. We believe that health care systems worldwide will embrace technology that delivers better patient solutions with greater efficiency, and that is the Enlitic solution.”

Dr Anthony Upton, Chairman Medical Advisory Committee – Capital Radiology:

“Enlitic will forever change the way radiology and all of medicine is practiced. Within the urban setting, this new technology will be an exceptional adjunctive tool that will improve accuracy and efficiency ultimately delivering optimal patient outcomes. Globally, it will deliver healthcare to populations that have none.”

Enlitic CEO Jeremy Howard commented:

“The vast digitization of medical information combined with recent breakthroughs in deep learning has created an extraordinary opportunity to change lives. Enlitic’s collaboration with Capitol will capitalize globally on this convergence through integration of Enlitic's deep learning platform, tools and world leading data scientists with Capitol's expertise, network of diagnostic imaging centers, and archives - driven by a standardized set of world class protocols and processes. Together we will commercialize the most sophisticated tool developed for medical decision-making to improve patient outcomes, medical workflow and costs.”

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Capitol Health Limited (ASX: CAJ) is an Australian public company providing medical diagnostic imaging (DI) services. It is the largest community based (non-hospital) DI provider within Victoria. The Company’s objective is to build a leading primary healthcare business across Australia generating sustainable growth and profitability for shareholders whilst delivering a superior patient experience.

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