

Supercomputing is Driving Medical Innovations including Gene Therapy to Improve Diagnosis and Personalize Treatment Options

Executive Summary

- A supercomputer performs at or near the currently highest operational rate for computers. Supercomputing has been making great strides in last few decades in terms of boosting computational power commonly measured in floating-point operations per second (flops). FLOPS denotes how many mathematical operations involving decimal fractions the computer can handle in one second. The Cray-2 released in 1985 operated at 1.9 gigaflops (10^9 flops). As of 2015, there were supercomputers that performed up to petaflops (10^{15} flops). In 2016, the world's fastest supercomputer delivers performance of about 125 petaflops. It is expected that an exaflop (10^{18}) supercomputer will emerge by 2020.
- These top-of-the-line computational devices have been used for scientific and engineering applications to either handle enormous amount of data or execute massive volume of calculations or both for such tasks as weather forecasting and fluid dynamics (like modeling air flow around airplanes and automobiles) in the 1970s and probabilistic analysis in the 1980s. The use of supercomputing in life sciences research possibly started when IBM's Blue Gene family of supercomputers were used in Lawrence Livermore National Laboratory in the U.S. for biochemical applications in 2005.
- Due to their capability of analyzing voluminous data at incredible speed, supercomputers have played an expanding role in life sciences over the past 10 years or so, ranging from genomic research, drug discovery to helping physicians to make more accurate and speedy diagnosis and create personalized treatment plans that could minimize medical expenses by reducing unnecessary lab tests, and enhance patient experience. The following are major examples of practical use of supercomputing in life sciences.
 - To get an indication of the cause of cancer for instance, a cancerous gene will be compared with a healthy gene. But each gene is composed of 3 billion base pairs, and it is the sequence of these base pairs that matters, so about 120 billion sequences have to be looked at before identifying the abnormal gene. Supercomputing can expedite this process. After that a virus can be engineered to infect the cancerous cells with the "good DNA" to treat the disease instead of using drugs or surgery. This experimental technique is called gene therapy.
 - IBM's Watson is the first commercial supercomputer with cognitive technology that can think like a human and is dedicated to the study like medical theories. It represents a new era of computing, as IBM Watson can learn and cumulate knowledge over time, analyze huge volume of data, and understand complex questions posted in natural language. Most importantly, it can provide evidence-based answers to avoid doctors' mis-diagnosis and create effective personalized treatment plans.
- China and the U.S., the two distinctive global leaders in supercomputing, have been competing head-to-head to be the number one in this space. However, the private sector of these two supercomputing superpowers has been in collaboration. IBM and Hangzhou CognitiveCare have forged a partnership with 21 Chinese hospitals initially to utilize Watson for personalizing cancer care.
- We believe supercomputing will have an increasingly significant impact on the life sciences industry from research to helping doctors in determining the optimal treatment option. But, supercomputing has to overcome the hurdles of having relatively high infrastructure and maintenance expenses as well as restricted access by the average physician before it can benefit the patient population to a larger extent.

IMPORTANT DISCLOSURES

Cedrus Investments Ltd. (“Cedrus”) does and seeks to do business with companies covered in research reports distributed by Cedrus. Investors should consider this report as only a single factor in making their investment decision.

For additional information, please send an e-mail to information@cedrusinvestments.com

For private circulation only. This report is prepared by Cedrus and is for informational purposes only and is not intended to be, nor should it be construed to be, an advertisement or an offer or a solicitation of an offer to buy or sell any securities. The information herein, or upon which opinions have been based, has been obtained from sources believed to be reliable, but no representations, express or implied, or guarantees, can be made as to their accuracy, timeliness or completeness. The information and opinions in this report are current as of the date of the report. We do not endeavor to update any changes to the information and opinions in this report. Unless otherwise stated, all views expressed herein (including estimates or forecasts) are solely those of our research department and subject to change without notice.

The information provided in this research report is not provided to and may not be used by any person or entity in any jurisdiction where the provision or use thereof would be contrary to applicable laws, rules or regulations of any governmental authority or regulatory or self-regulatory organization or clearing organization or where Cedrus is not authorized to provide such information.

This report does not take into account the specific investment objectives, financial situation, and the particular needs of any specific company that may receive it. Before acting on any information in this report, readers should consider whether it is suitable for their own particular circumstances and obtain professional advice related to their own investment needs and objectives. The value of securities mentioned in this report and income from them may go up or down, and investors may realize losses on any investments. Past performance is not a guide to future performance. Future terms are not guaranteed, and a loss of original capital may occur.

Neither the analysts responsible for this report nor any related household members are officers, directors, or advisory board members of any covered company. No one at a covered company is on the Board of Directors of Cedrus or its affiliates. The compensation for the analysts who prepare reports is determined exclusively by senior management. Analyst compensation is not based on investment banking revenues; however, compensation may relate to the revenues of Cedrus as a whole, of which investment banking, sales and trading are a part.

Cedrus does engage in investment banking. Cedrus does trade securities on a principal basis; however, Cedrus’ research analysts are prohibited from owning securities they cover through Research Reports.

Copyright 2017 Cedrus Investments Ltd. All rights reserved. Any unauthorized use or disclosure prohibited.