aws

A University Perspective:

The Real-World Approach to Building Cloud Skills

WHITE PAPER

At a time when IT skills are in short supply, academic institutions struggle to meet demand, and the world continues to wrestle with a pandemic, the University of British Columbia (UBC) has come up with a way to address all three needs—and more—at the same time.

UBC launched a Cloud Innovation Centre (CIC) in collaboration with Amazon Web Services (AWS) in January 2020. This is a practical approach to teaching computer science and technical skills by applying student innovation and a full range of cloud services to real-world problems in a process the university calls work-integrated learning.

Students accepted into the CIC cooperative education (co-op) program spend between four and eight months working on a project that impacts health, the environment, education, and other public interest issues. Marianne Schroeder, the centre's director said, "There are three requirements for a project to be accepted into the UBC CIC: It needs to solve a big societal problem, lend itself to a collaborative format, and the solution needs to be published as open source."

The open-source element is part of the program's commitment to apply shareable, repeatable, and sustainable technology solutions that benefit others. Code is published under the Massachusetts Institute of Technology (MIT) open-source license, which is considered one of the most permissive in the industry, and any person or organization is free to build upon it.

It didn't take the UBC CIC team long to find a candidate for its services. Following launch, the COVID-19 pandemic challenged scientists to untangle the mysteries of the new virus around the world. They initiated the first CIC project in response.

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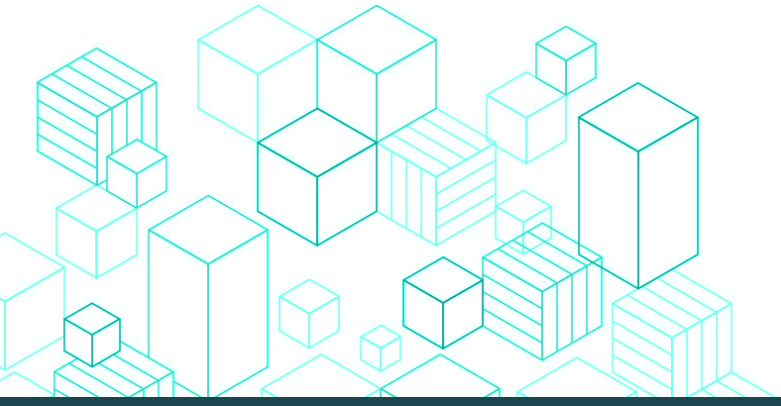
Transformational learning

Even before COVID-19 lockdowns began, radiologists at Vancouver General Hospital were assessing the viability of developing an artificial intelligence model to analyze computer tomography scans of COVID-19 infected patients. The goal was to empower clinicians with statistical information about the infection to help in identifying elements in computed tomography (CT) scans that aren't easily visible to the human eye.

Vancouver General Hospital worked to gather CT scans of the lungs of infected patients from around the world. Students in the UBC Faculty of Medicine annotated the images, and professional radiologists labeled the opacities, or diseased areas, within the tissue. The UBC CIC team, which included students from earth sciences, computational sciences, and biomedical engineering, worked with AWS experts to develop an artificial intelligence (AI) model that compares COVID-19-positive scans to images from the lungs of patients who had similar systems but weren't infected. The goal of the ongoing project is to give radiologists additional information they can use to decide whether patients presenting with symptoms are likely to be COVID-19 victims.

They released the first COVID AI model in August 2020, then shared a second version that incorporates greater prognostication capabilities six months later. The project has grown to include several additional technology providers with all code released to open source so any healthcare provider can use it. "It really was the right project at the right time given the global challenges we were facing," said UBC associate provost Simon Bates.



Across-the-board innovation

In addition to the UBC CIC's first project, UBC CIC students have completed more than 20 initiatives spanning a wide range of scientific, public service, and academic uses that display work-integrated learning in action. UBC's CIC program is one of thirteen that AWS supports through its Cloud Innovation Centers program. AWS provides expertise and AWS Promotional Credit toward usage of its cloud platform, as well as furnishes a team of employees who excel in applying AWS technology and Amazon's Working Backwards principles and methodologies to define problems and solutions. Participating academic institutions contribute students and faculty experts to help identify candidate projects and develop prototypes.

For example, the Can't Wait project brought together teams from UBC, Vancouver Coastal Health, Provincial Health Services Authority, SapienML, and AWS in a collaboration aimed at making administration of magnetic resonance imaging (MRI) scans more efficient across the province.

Patients awaiting MRIs are typically placed in a priority queue based upon the severity of their condition. That means stroke patients may be treated in a matter of hours while those with less critical conditions can wait months. Decisions are made by individual clinicians based on experience, but often without a broader corpus of contextual information.

The Can't Wait initiative built a prototype using Amazon Comprehend language services to analyze requisition forms submitted by British Columbia's central intake office for MRI services. The rules-based algorithm predicts priority values, based on criteria specified in the requisition.

"The Can't Wait project helps the central intake office assign the patient to the MRI site with the fastest turnaround time for the condition," Bates said. "We were looking to drive down wait-list times and also the number of patients who receive their exam within the province's benchmark time period. Like all other UBC CIC projects, the code is open-sourced for anyone to build upon."

In addition to Can't Wait, another project the UBC CIC developed, The Sea Around Us in The Cloud, addresses the need for scientists, conservationists, and researchers to analyze the 70 years of worldwide fisheries-related data gathered by the Sea Around Us (SAU) international research initiative at UBC.

As data volumes grew over time, SAU's website had become a bottleneck for processing the often-complex queries members need to run. "There were limited datasets available for download on the SAU website. However, these available datasets did not fulfill the requirements of many specific user needs, most of which needed customized datasets, so this challenge needed to be resolved," said Sea Around Us researcher Dr. Deng Palomares.

The UBC CIC team developed an alternative approach using AWS Lambda, a serverless computing framework, in conjunction with Jupyter notebooks, which are flexible interactive development environments that support a wide variety of languages, workflows, and reporting options.

Jupyter notebook templates were built containing data analysis and visualization examples along with the underlying code and instructions for creating and using code blocks. The solution shifted processing from the website to user notebooks, potentially offloading up to 80 percent of customized data requests. That meant more people could access the data and conduct more sophisticated queries on it.

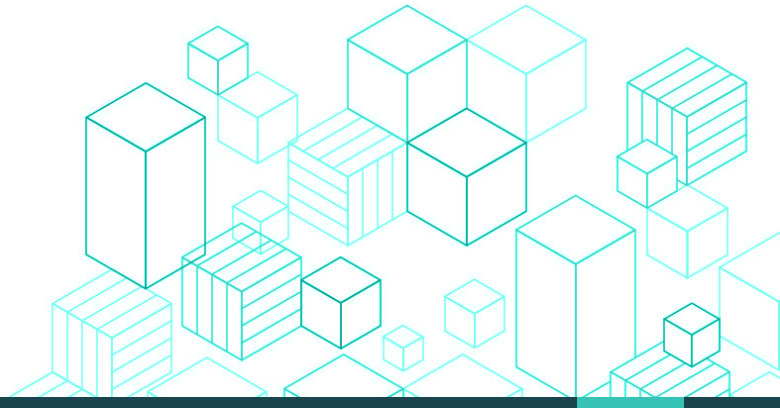
"The expertise provided by the UBC CIC team enabled the creation of a novel data interpretation and display platform that can be delivered to users with customizable data extraction," Palomares said. "The platform reduces the time that the Sea Around Us team puts into responding to user needs and assures that the Sea Around Us data is available for direct consultation by advanced users."

Learn by doing

Fourth year computer science student Neelim Novo spent a year in the UBC CIC co-op program working on two projects. The first aimed at helping non-emergency dispatch services make better decisions about how to handle incidents by transcribing the contents of incoming calls and performing some basic natural language processing to assess their criticality. The second created an application that new UBC students can use to connect with resources on campus that match their areas of interest.

Although AWS and UBC CIC employees were available to act as resources, Novo chose to do much of the training himself. "I learned mostly by doing," he said. He also attended some CIC workshops and student-led live labs.

The AWS-branded services Novo learned to apply included the Amazon Connect virtual call center, Amazon Transcribe, Amazon Comprehend, Amazon OpenSearch Service, Lambda for serverless computing, and Amazon DynamoDB. "They have something for almost everything; I was not aware of how much cloud companies had developed until now," he said.



Another UBC CIC project focused on learn by doing was done in collaboration with the University of Toronto Mississauga Department of Economics. The teams tackled the problem of extracting data from more than 30,000 documents that were created long before computers existed. Economists wanted to analyze the data to better understand trade patterns a century ago, but it was locked up in PDF files and had to be extracted by hand.
A prototype the team built used Amazon Textract, Lambda, Amazon Simple Storage Service (Amazon S3), DynamoDB, AWS Amplify, and Amazon Cognito. It automated the process of scanning tabular data from the PDF files and converting it into comma-separated format for easy access by machines.

Skills development with a purpose

More than 30 students have interned at the UBC CIC over the past two years through co-op programs, with most committing two school terms to the assignment before returning to classes. Students who complete the program aren't guaranteed a job, but with artificial intelligence, data science, and cloud computing skills topping the list of the jobs employers most need to fill, their career prospects are significantly enriched.

"I also learned a lot about how enterprises design software to be highly available and recoverable," Novo said. "What I learned is broadly applicable." And he picked up an AWS Solutions Architect Associate certification in the process.

Amazon's goal is to underscore the ease with which anyone can apply cloud-based technology. For instance, the AWS Education to Workforce (E2W) team helps connect early career cloud talent from the higher education system to AWS customers seeking to fill open cloud positions in local and regional markets. The E2W team convenes hiring companies to participate in four distinct work-based learning activities that are integrated into a student's learning pathway. These include: (1) capstone projects leveraging AWS online labs (such as AWS Academy Learner Labs); (2) capstone demonstration days that serve as experiential interviews for potential internships; (3) internships; and (4) guaranteed interviews for full-time employment positions with local or regional AWS customers.

"We often hear that companies don't have the training to use cloud-based technology tools," said Coral Kennett, education sales leader at AWS Canada. "Through work-based learning experiences, AWS customers are active participants in building the future cloud-skilled talent pipeline, and help ensure that cloud-skill pathways at Higher Education institutions remain connected to real-world jobs and skill demands so students and alumni alike are ready for the workforce on day one."