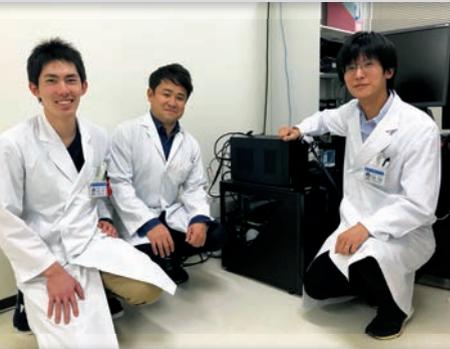


## XTREME-DNA Case Study

# Using Deep Learning in the Cloud to Increase Early Detection of Blindness



Associate Professor Hidenori Takahashi of Jichi Medical University (right) and colleagues.

“XTREME-DNA definitely increased our research performance. XTREME-D provides high performance computing options to many researchers who are not computer specialists.”

— Associate Professor  
Hidenori Takahashi,  
Jichi Medical University

## Diagnosing Eyeground Diseases via Algorithm

Jichi Medical University of Tochigi-ken, Japan, was established to provide highly skilled medical care to remote areas of Japan where medical aid is limited and to promote health and well-being to people living in rural communities. The university is also focused on contributing to the advancement of medicine through technology.

One application of Jichi’s technological focus can be seen in their adoption of deep learning to create a more thorough review of ophthalmological images. Diabetic retinopathy is one of the world’s leading causes of blindness. In regular physical examinations it’s not uncommon for only part of the retina to be captured, but sometimes symptoms can only be found in the parts of the retina not captured. Jichi developed an algorithm to predict the malignancy of the entire retina based solely on the captured image.

As a result of this technological adoption, Jichi now works to diagnose age-related macular degeneration and other eyeground diseases (diseases of the fundus of the eye, the inside of the bottom part of the eyeball) from eyeground photographs and Optical Coherence Tomography (OCT) images. The university is also able to detect illnesses such as conjunctivitis in the anterior segment of the eye based solely on eye surface photographs.

Jichi Medical University adopted deep learning to create a more thorough review of ophthalmological images. This technology allows for a more extensive patient examination, yielding far more data points.

### >>> Challenges

- Lack of access to the latest processing power in-house
- Lack of knowledge to troubleshoot in-house workstation builds

### >>> Solution

- Utilizing XTREME-DNA enabled a focus on research rather than on building the tools for research
- Access to parallel processing on four Tesla K80s
- Caffe and all necessary libraries already installed

### >>> Outcome

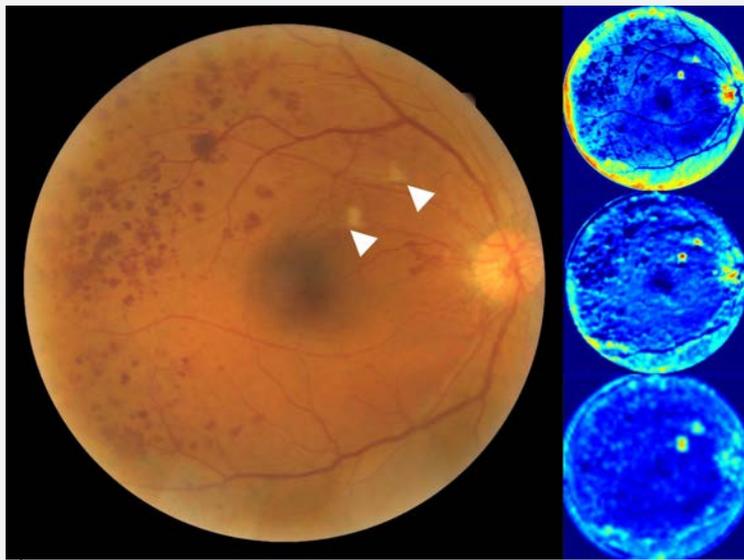
Massive productivity boost for the researchers.

# The Technology Behind the **D**etection

Jichi University applied deep learning by GoogLeNet, using Caffe to learn 10,000 fundus images, each in full color 1,272x1,272 pixel size. Since the university is focused on research rather than on building the supercomputing power necessary to process these images, they turned to XTREME-DNA, a cloud-based, virtual, supercomputing-on-demand service offered by HPC cloud company XTREME-D.

XTREME-DNA uses templates developed by highly skilled HPC architects to provide users with access to a customized, configured, ready-to-use system in as little as 10 minutes. HPC templates are like recipes written by the HPC architects, who use their know-how and experience to construct the optimal OS, application, middleware, and setup necessary for specific execution or testing. Cost savings extend beyond equipment, as engineers with the specialized skills required to construct complex clusters are no longer needed to build or maintain them.

To facilitate deep learning for this project both input and verification files were uploaded to the cloud in Lightning Memory-Mapped Database (LMDB) format. Jichi's virtual supercomputer utilized parallel processing on four Tesla K80s, which allowed for much faster and steadier learning than was possible on traditional CPUs.



Fundus images.

Jichi staff was very impressed to find that Caffe and all necessary libraries were already installed in the HPC template they selected for this project. "Compared to spending hours troubleshooting our own workstation builds, all we had to do was to log in and select the templates we wanted to use," said Associate Professor Hidenori Takahashi of Jichi Medical University. "This massive productivity boost enabled us to concentrate on our research instead of on building the tools for research."

## What's **N**ext for Jichi's Research Endeavors?

To date Jichi's deep learning project has only utilized Caffe, but the university's researchers would like to try other deep learning frameworks as well, such as Toach7 and TensorFlow. It will be easy for them to test whether these frameworks are more efficient than what they've already tried because XTREME-D's HPC templates already contain everything they need for testing in multiple frameworks.

"It's not reasonable for an ophthalmologist to be able to assemble a high performance workstation," said Takahashi while bemoaning the fact that his facility only has one TITAN card running on NVIDIA's new Maxwell architecture. "So I recommend the cloud. XTREME-DNA was a reliable and economical solution, as it only incurs cost when you want to use it." XTREME-DNA provides Jichi University access to an NC24 Azure GPU instance that can perform calculation processing up to three times as fast as what the university is able to access in-house.