



# Containerizing Neural Network Apps for Medical Compute

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# Vision and Goals

Over the past few decades, there has been a tremendous amount of work done in the area of computational medical research. Researchers used image processing, machine learning and neural networks to determine certain patterns in diseases.

However, we can question the practical impact of these improvements. The lack of easy access to data and computational power became the largest obstacle for the non-technical users.

Our goal is to develop an application that provides a text report of brain MRI images using neural networks for clinical users at Boston Children's Hospital.



ChRIS ChRIS



FNNDS  
Fetal-Neonatal Neuroimaging  
Development Science Center



Boston  
Children's  
Hospital



HARVARD MEDICAL SCHOOL  
TEACHING HOSPITAL

## What is ChRIS?

An open source platform with a web GUI that uses cloud technologies for medical application development.

## Why Use ChRIS

1. More Data
2. More Compute
3. More collaboration

## For whom?

As a clinical user, I want to be able to easily access both data and computation results of medical images, therefore I need a user-friendly platform ChRIS whose plugins can perform medical level computation for me.

# Our Plugin

## Input:

Our plugin will convert DICOM files to images compatible with classifiers.

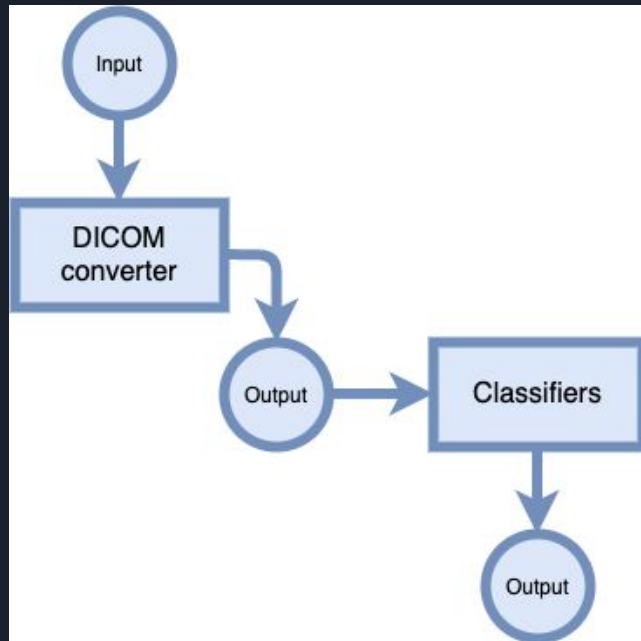
## Explore Two Neural Network Types:

One classifier that attempts to segment multiple classes concurrently and provide classification of each part of the brain.

Another classifier that uses many (100's of smaller classifiers for one specific anatomical feature of the brain.

## Output:

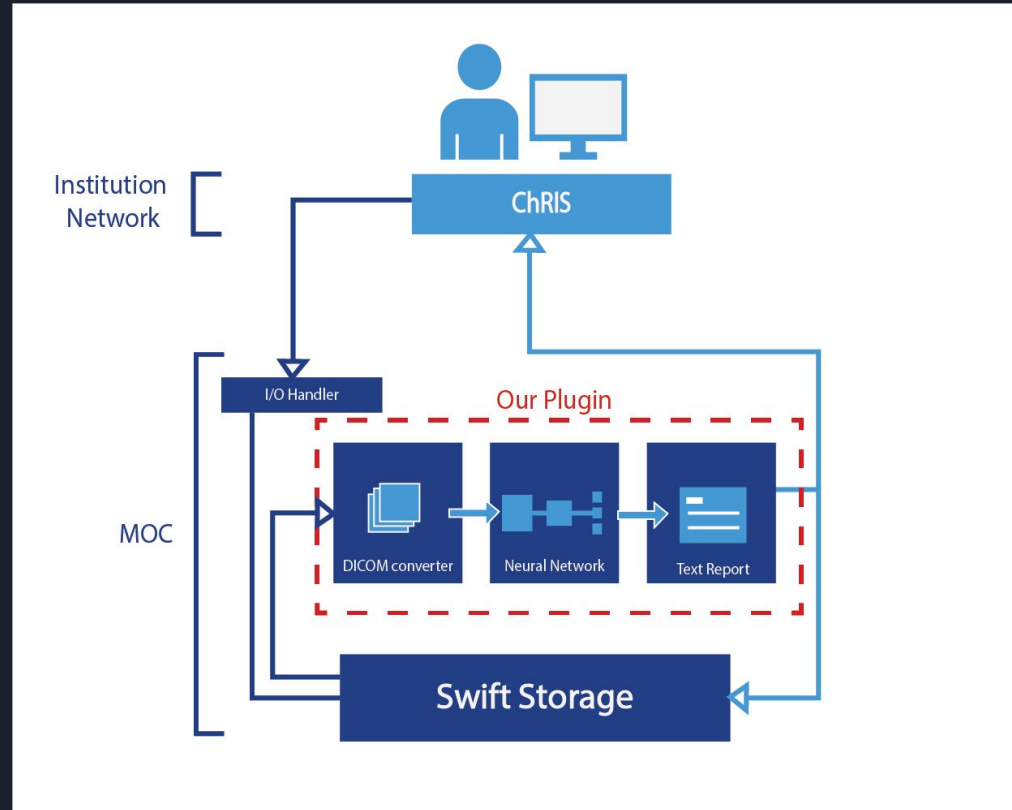
A text file regarding the classifiers and information regarding brain anatomy (ie: volume)



# Architecture

**ChRIS backend and frontend:**  
can live on your local machine or  
within your institution.

**Data Computation:**  
Performed on the MOC:  
IO Handler/ProcessManager  
(Openshift)  
Swift Storage (OpenStack)

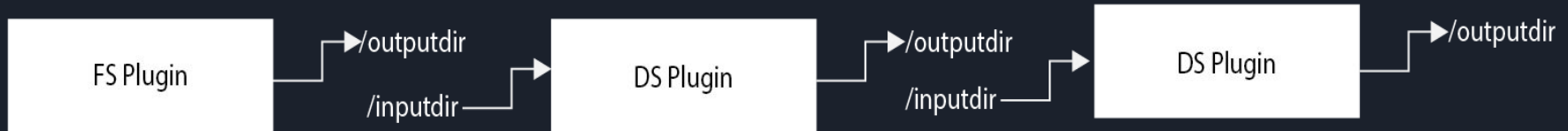


# Plugin Format

Two types:

**Feed Synthesis (FS):** First plugin in a “Feed” chain. They have no input, and primarily only have outputs that generate data in response to a behavior. For example dragging and dropping files from a local directory.

**Data Synthesis (DS):** output of a Feed Synthesis plugin becomes input of Data Synthesis. This can be a data converter, classifier, data to PDF file, etc.



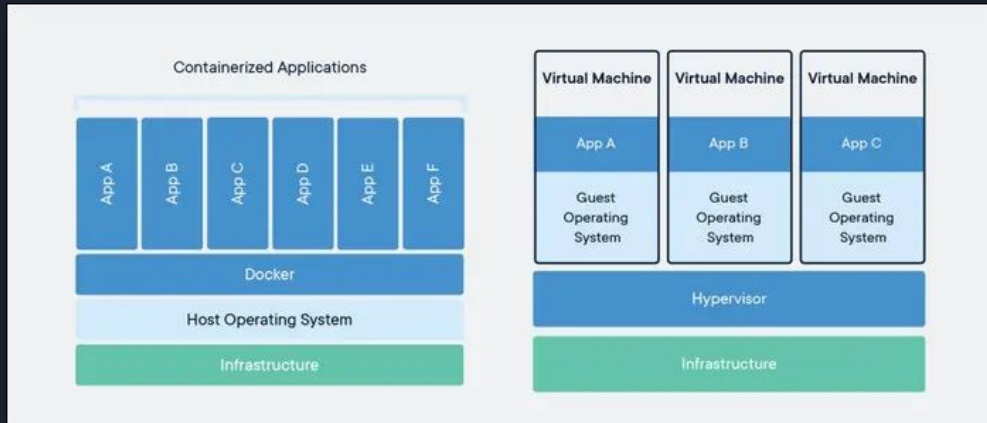
# Docker

Docker is an application that allows code to run on any computer that would need a certain operating system or set off dependencies to run off of.

The code plus dependencies is called a container.

ChRIS -- everything is built as OCI images.

Standardizes Image Processor Development -- this allows portability (can run from your laptop)





# DEMO

Run ChRIS plugins on backend

Showcase a plugin working in ChRIS backend

Run ChRIS UI

Showcase login procedure / Relate back end to front end





## Next steps:

1. Work on DICOM converter
2. Exploring some existed neural network plugins
3. Exploring some report generator plugins
4. Research on two types of classifiers



# Quiz

What is an advantage of containerized applications as docker images?

- A. It allows easy access for storing inputs and outputs.
- B. It allows clinical personal to use the code without the needing to know how to program.
- C. It allows portability of applications anywhere.
- D. It allows better quality imaging.

What will our plugin transform MRI scans into? (our total plugin output)

- A. **Text reports**
- B. Numpy arrays
- C. Binary Vectors
- D. Bread



What are the two classifiers we are exploring?

- A. One neural network that identifies brain tumors.
- B. One neural network that outputs classification of each part of the brain.
- C. Hundreds of neural networks that each outputs classification of separate parts of the brain.
- D. A & B
- E. B & C

Where does the data computation take place in the overall architecture?

- A. Your personal computer
- B. ChRIS backend
- C. ChRIS frontend
- D. The Mass Open Cloud