Training

Overview

YouTube Videos | Workshops and Schedule | Machine Learning in Python | Machine Learning in R | External Resources Training | Self Guided Training | Data Center Video Tour

HPC Workshops

Every semester, we offer a variety of workshops including, but not limited to, Intro to HPC, Intro to Machine Learning, Intro to Parallel Computing, Intro to Containers, and Data Management Workshops. Check the Workshops and Schedule section below to see the dates of our upcoming sessions or check out the links on the right-hand side for detailed information. We announce upcoming workshops through the hpc-announce listserv so if you do not see any workshops scheduled, keep your eye on your inbox. You may also want to look through our detailed pages for course slides, video presentations, and interactive guides.

External Training Resources

Other organizations provide great training opportunities. Check out this list for upcoming events.

Self Guided Training

Need some help getting started with Linux, GPU programming, Singularity, OpenMP, or Matlab? Check out the Self Guided Training section below for resources to get you up and running.
YouTube Videos

These videos are available to watch on our YouTube Channel

<table>
<thead>
<tr>
<th>Title</th>
<th>Video</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPC Data Center Tour</td>
<td><img src="image" alt="HPC Data Center Tour" /></td>
</tr>
<tr>
<td>Using Cut and Paste in the OnDemand Desktop (no audio)</td>
<td><img src="image" alt="HPC copy paste" /></td>
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<tr>
<td>HPC Memory to Core Relationship</td>
<td><img src="image" alt="HPC Core to Memory Relationship" /></td>
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<tr>
<td>Visualization on HPC Using ParaView</td>
<td><img src="image" alt="Visualization on HPC" /></td>
</tr>
<tr>
<td>Running a Jupyter Notebook from Singularity</td>
<td><img src="image" alt="Running a Jupyter Notebook from Singularity" /></td>
</tr>
<tr>
<td>Python Virtual Environments (virtualenv)</td>
<td><img src="image" alt="Python Virtual Environments" /></td>
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Workshops and Schedule

These workshops are all introductory by nature. If you want more advanced workshops, the Data Science Institute conducts a broad range that can be found on their calendar.

Intro to HPC
Introduction to HPC

Click here for more detailed information

Upcoming Workshops

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<tr>
<th>Date</th>
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Machine Learning on HPC

Machine Learning on HPC

Click here for more detailed information

Machine Learning in Python

Machine Learning in Python

This short training class provides a brief introduction to key concepts of machine learning. The short lecture will be followed by two hands-on examples that emphasize running a Jupyter notebook on the HPC supercomputers. For the presence workshop you can stick around and use this as a consulting session.

Upcoming Workshops

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Machine Learning in R

Machine Learning in R

This short training class provides a brief introduction to key concepts of machine learning. It’s a little different from the above one even considering the focus on R instead of Python. The short lecture will be followed by two hands-on examples that emphasize using RStudio on the HPC supercomputers. You can use RStudio on your laptop if you prefer.

Upcoming Workshops

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<th>Registration</th>
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Intro to Parallel Computing

Introduction to Parallel Computing

Click here for more detailed information

Upcoming Workshops

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Intro to Containers
Introduction to Containers on HPC

Click here for more detailed information

Upcoming Workshops

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| Intro to Linux     |          |                    |              |

Introduction to Linux on HPC

Click here for more detailed information

This workshop is not taught in person but is intended to briefly cover general usage of the command line environment on HPC

Data Management Workshops

Upcoming Workshops

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<th>Location</th>
<th>Registration</th>
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</table>

| Nvidia Workshop    |          |                    |              |

Nvidia Workshop

Nvidia Workshop

Nvidia workshop taught by Nvidia staff.

Free lunch. Pizza will be provided at Noon.

This workshop will have Nvidia staff present. You can learn about their technologies particularly with Machine Learning and AI, ask them questions

<table>
<thead>
<tr>
<th>Subject</th>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Registration</th>
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</thead>
<tbody>
<tr>
<td>Nvidia Workshop</td>
<td>Friday September 30, 2022</td>
<td>12 - 3pm</td>
<td>Main Library B252</td>
<td>Registration</td>
</tr>
</tbody>
</table>

Abstract

In this session we will cover some of the most popular and effective GPU accelerated libraries that give high performance without the requirement of writing your own custom GPU code. We will cover CUDA-X which has libraries for math, image/video processing, deep learning, and GPU tailored partner libraries. On top of CUDA-X we will cover RAPIDS which will target data science and data analytics workloads. We will conclude the session with interactive coverage of NVIDIA's profiling tools. We will conclude with a brief coverage of Python specific tools we have like CuPy and Numba for customizable GPU accelerated code. By the end of the workshop, you'll have the skills to utilize existing GPU accelerated libraries and write your own Python codes with NVIDIA GPUs!

Learning Objectives:

- Introduce RAPIDS and CUDA-X for drop-in GPU-accelerated libraries
- Introduce CuPy and Numba for GPU accelerated Python code

Chapel Workshop
Chapel Parallel Programming Language taught by Dr Michelle Strout

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<thead>
<tr>
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<th>Registration</th>
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<tbody>
<tr>
<td>Chapel Workshop</td>
<td>Friday February 3, 2023</td>
<td>9:00 - 11:00AM</td>
<td>Main Library B252 Learning Studio CATalyst</td>
<td>Registration</td>
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Chapel Tutorial for Python Programmers: Productivity and Performance in One Language

Many users of HPC systems are also Python programmers. Python is a great programming language for prototyping data analyses and simulations, but things become more challenging when trying to leverage cross-node and within-node parallelism. In this tutorial, we present the general-purpose Chapel programming language for productive, parallel programming. Participants can experiment with Chapel code examples from applications such as k-mer counting, solving a diffusion PDE, sorting, and image processing. For hands-on activities, we provide a container for quick setup and instructions on how to use Chapel on the UArizona HPC systems. Active learning exercises such as online multiple choice about converting common Python patterns into Chapel code enable participants to check what they have learned. Throughout the tutorial, existing large applications written in Chapel are highlighted with quotes from their developers and example code snippets showing Chapel usage in production. We also give a brief introduction to Chapel's newfound support for GPU programming. Come join us for a fun couple of hours exploring how to write parallel programs in a productive and performant way!

Prerequisites: Please install podman (https://podman.io/) on your laptop beforehand or bring along a friend who has it installed on their laptop and is willing to share. Here is how you could install and start it on a mac:

```
brew install podman                   // ignore the llvm15 dep error
podman machine init
podman machine start
podman machine stop                  // what you can use to stop it
```

Here are the commands you can use to do an initial test of chapel ahead of time if you would like:

```
podman pull docker.io/chapel/chapel     // takes about 3 minutes
echo 'writeln("Hello, world!");' > hello.chpl
podman run --rm -v "$PWD":/myapp -w /myapp chapel/chapel chpl -o hello hello.chpl
podman run --rm -v "$PWD":/myapp -w /myapp chapel/chapel ./hello
```

External Resources Training

Data Science Institute

The Data Science Institute is a UArizona organization that provides training, support services, and connections for those in the computing/data science community:

"The Data Science Institute facilitates collaboration across an increasingly diverse and active Data Science community by providing workforce development, essential technological assistance, and training to University partners. Formerly Data7, the Data Science Institute aims to foster the next generation of data-driven research by encouraging university-wide interdisciplinary collaboration, gaining external visibility, developing industry alliances, and increasing funding for research at the University of Arizona (UA)."

For a list of upcoming training workshops, see: https://datascience.arizona.edu/calendar

Self Guided Training

Linux
Linux Self Guided

We run RHEL/CentOS 7 Linux on our high-performance systems. The workshop above is tailored to our HPC command line environment. Additional information includes this useful guide: [http://www.ee.surrey.ac.uk/Teaching/Unix/](http://www.ee.surrey.ac.uk/Teaching/Unix/)

Or try this one: [https://www.pcwdid.com/linux-commands-cheat-sheet](https://www.pcwdid.com/linux-commands-cheat-sheet)

Shell Computing

[https://effective-shell.com/](https://effective-shell.com/)

Matlab

**Matlab Training**

**Matlab Online Training**

Matlab offers a number of free tutorials including these ones:

- Training Overview
- Machine Learning Onramp
- Deep Learning Onramp

Resources from the recent workshop:

- Slides and Exercises from today’s workshop can be downloaded at - [https://tinyurl.com/DeepLearning-MATLAB-Arizona](https://tinyurl.com/DeepLearning-MATLAB-Arizona)
- Free online training - Introduction to MATLAB - [MATLAB Onramp](https://www.mathworks.com/training/matlabsr-onramp.html)
- Free in-depth MATLAB training – [MATLAB Fundamentals](https://www.mathworks.com/training/matlabsr-fundamentals.html)
- Free online training - Introduction to Deep Learning – [Deep Learning Onramp](https://www.mathworks.com/training/deepr-learning-onramp.html)
- Free in-depth Deep Learning training - [Deep Learning with MATLAB](https://www.mathworks.com/training/deepr-learning.html)
- More Resources (e-books, videos) and Examples (to help you get started with your projects)

**Matlab Workshops at UArizona**

**Deep Learning In Matlab**

October 28, 2021

Learn how you can use MATLAB to apply deep learning techniques to your work whether you’re designing algorithms, preparing and labeling data, or generating code and deploying to embedded systems. For resources shared at the workshop see the bottom of this page.

**Details**

**Tackling Big Data with Matlab**

April 5, 2022

In this seminar you will learn strategies and techniques for handling large amounts of data in Matlab. New big data capabilities in Matlab will be highlighted including tall arrays.

**Details**

**Singularity**
Singularity Training

Singularity is now called Apptainer but it is functionally the same.

Singularity containers let users run applications in a Linux environment of their choosing. This is different from Docker which is not appropriate for HPC due to security concerns. Singularity is like a container for Docker images, but is not just for Docker.

The most important thing to know is that you create the singularity container called an image on a workstation where you have root privileges, and then transfer the image to HPC where you can execute the image. If root authority is an issue then the answer might be a virtual environment on your laptop, like Vagrant for MacOS.

For an overview and more detailed information refer to: Singularity Quick Start.

Here are some of the use cases we support using Singularity:

- Portability and reproducibility
- You already use Docker and want to run your jobs on HPC
- You want to preserve your environment so that a system change will not affect your work
- You need newer or different libraries than are offered on HPC systems
- Someone else developed the workflow using a different version of linux
- You prefer to use something other than Red Hat / CentOS, like Ubuntu

Nvidia/GPU

GPU/Nvidia Training

Nvidia offers AI, Data Science and accelerated computing curriculum with access to GPU's and course material. You can use our Nvidia GPUs also.

Nvidia Deep Learning Institute

See their web site for more information on the University Ambassador Program, Teaching Kits and Certifications.

OpenMP
Introduction to OpenMP

This PDF file is a presentation from a series called Xsede * HPC Workshop.

* XSEDE, the Extreme Science and Engineering Discovery Environment, is the most advanced, powerful, and robust collection of integrated digital resources and services in the world. It is a single virtual system that scientists and researchers can use to interactively share computing resources, data, and expertise. XSEDE integrates the resources and services, makes them easier to use, and helps more people use them.

Data Center Video Tour

You may not get to see the actual supercomputers where you work is done, but you can watch this tour. Note how loud it is in the room. The video does not convey the temperature of the room, but there are no warm areas. As you will hear explained, the cooling is done with chilled water.

Data Center Virtual Tour