

Guidelines for Cloud Resources

Machine Learning Engineering Career Track

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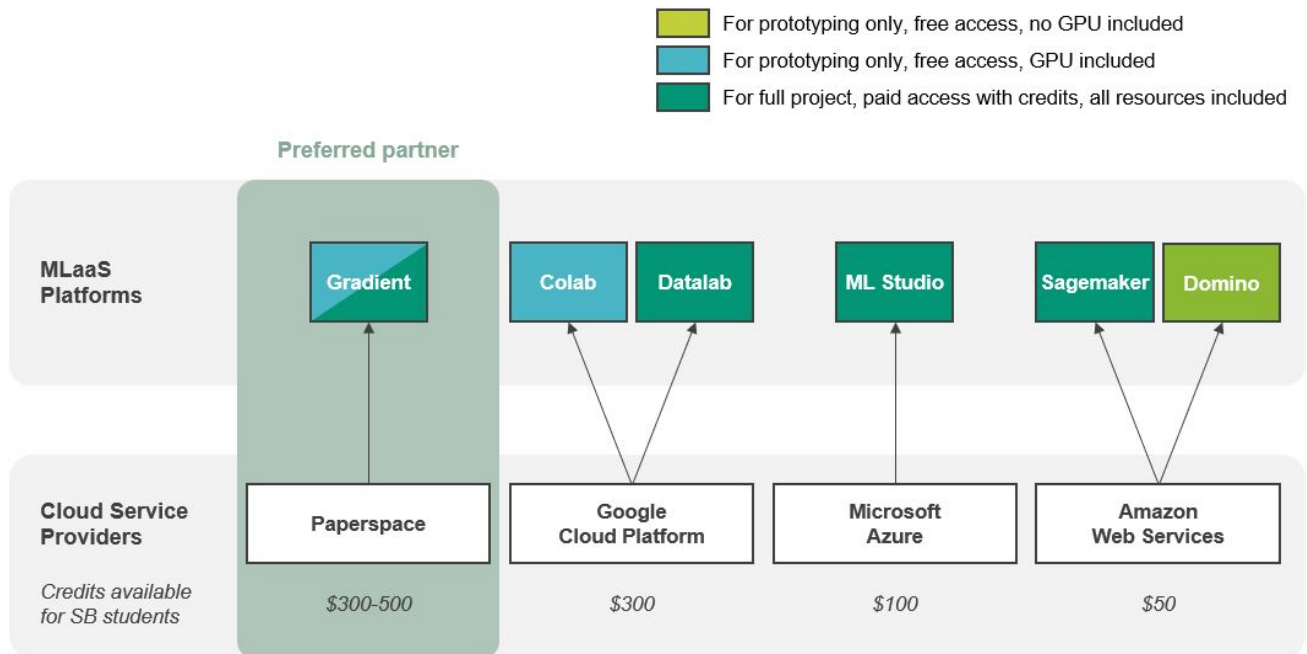
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Summary of resources

As part of this course, students can choose among several free and paid cloud resources. We'll update this section (and the rest of this doc) as we continue to build our partnerships and provide more resources to our students.



Summary of cloud resources provided by Springboard

Cloud Providers vs. MLaaS Platforms

In order to clarify the cloud resources that students have access to, we first need to distinguish between the two levels of resources available.

Cloud Providers

When people think of the ‘cloud’, they typically are thinking of cloud providers such as AWS or Google Cloud. These are companies that actually provide the machines and hardware that you’ll be running your code on: whether it’s computational power or storage. The business model for all of these cloud providers is the same; you pay for the types of resources that you use, and for the time you spend using them. There are four cloud providers that we support.

| Cloud Provider | Available credits | Pros | Cons |
|-----------------------------|-------------------|--|---|
| Paperspace | \$300-\$500 | <ul style="list-style-type: none">- Springboard Preferred Cloud Provider- Focused on GPUs tailored for ML/AI applications- Known for ease of use | <ul style="list-style-type: none">- Relatively new and smaller player in the market |
| Google Cloud Platform (GCP) | \$300 | <ul style="list-style-type: none">- Most popular among startups and smaller companies- Strong with containers and scaling- Many tools focused on Big Data and ML | <ul style="list-style-type: none">- Lags behind AWS and Azure in adoption- Can be confusing to figure out the right service to use e.g. Colab vs. Cloud ML vs Datalab |
| Microsoft Azure | \$100 | <ul style="list-style-type: none">- Mostly used in large enterprises- Ties into many different Microsoft tools | <ul style="list-style-type: none">- Can lock you into many Microsoft-specific non-standard tools and libraries- Not commonly used in startups and smaller companies- Some of the services can be immature and buggy |
| Amazon Web Services (AWS) | \$50 | <ul style="list-style-type: none">- The de facto leader in cloud service platforms- Many ML-focused services e.g. SageMaker | <ul style="list-style-type: none">- Difficult to set up and use, known for confusing and opaque cost structure- Difficult to monitor usage, easy to overrun on cost |

Summary of the cloud providers supported by Springboard, with available free credits

PaperSpace (Preferred Partner Platform)

PaperSpace is our preferred cloud provider. This is a relatively young and new competitor to the Big Three cloud providers (AWS, GCP and Azure), focused heavily on ML/AI, efficient use of GPUs and ease of use.



As a Springboard student, you have \$300 - \$500 available in Paperspace credits to use as you wish for your Capstone project. You'll start with \$300. If you find that you need more, you'll have to make the case for it (with your mentor's approval) and we'll consider providing \$200 more in credits on a case-by-case basis.

However, if you choose not to use Paperspace and instead choose to use a different provider, you'll have to pay out-of-pocket if you run out of your Springboard-provided credits.

1] Get your Paperspace code

Please send an email to support@springboard.com asking for your Paperspace code. Once you receive the code, you can use it within your Paperspace account.

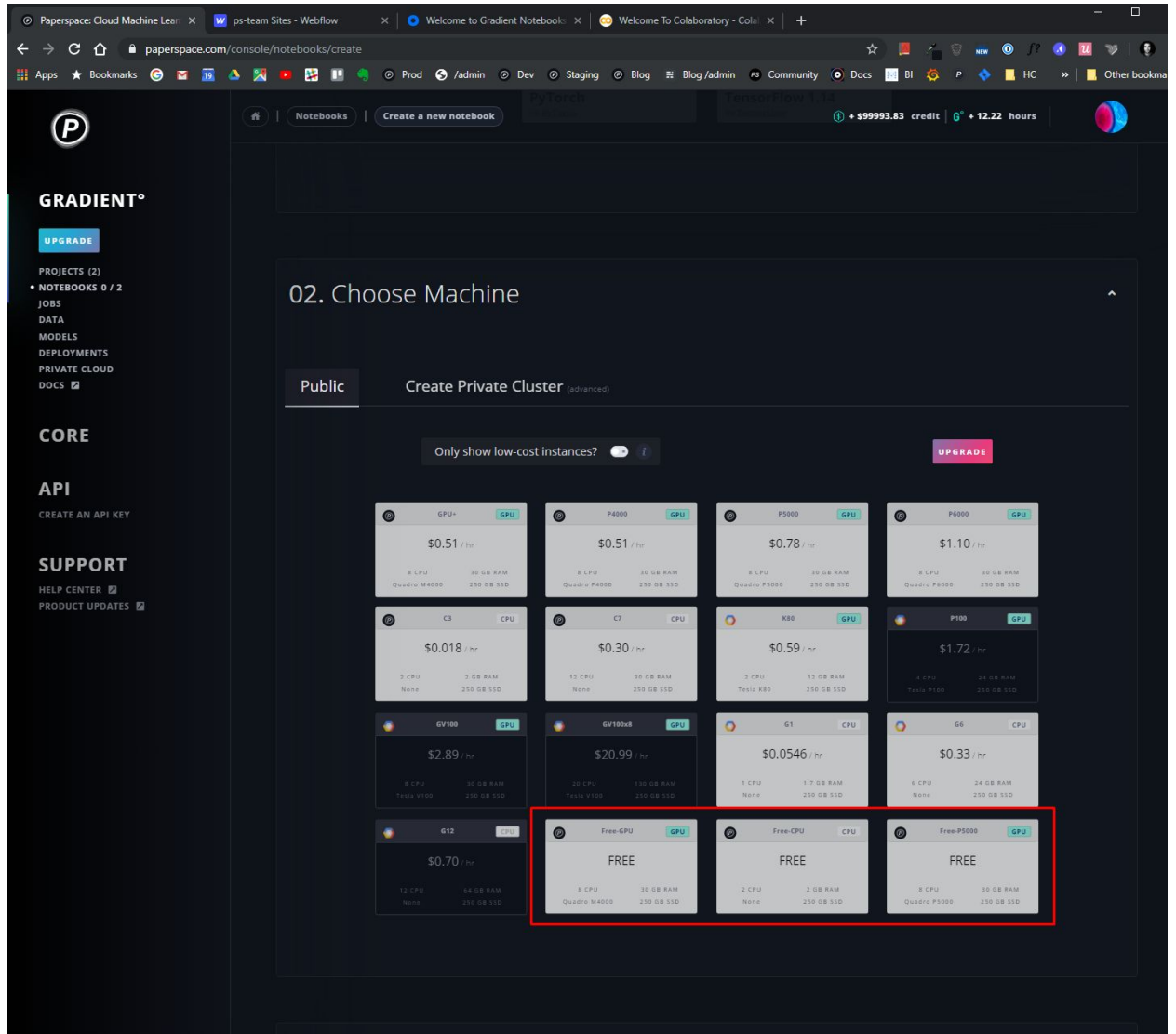
2] Get started with Paperspace

1. Go to <https://gradient.paperspace.com>
2. If you don't have an account already, create one using your Github account
3. Log into Paperspace and navigate to <https://www.paperspace.com/console/notebooks>
4. Try out the free resources provided by Paperspace
5. Use the [Gradient documentation](#) for reference as needed

3] How to access the Paperspace Free Tier

Once you get to the [Notebooks](#) page on the site.

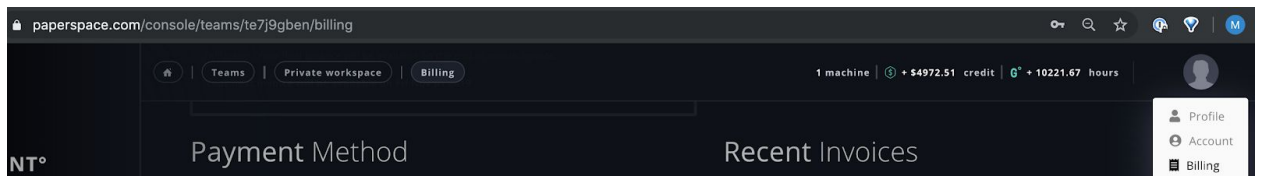
1. Choose a container. If you don't know what a container is, don't worry! For now, just think of it as a packaged set of tools and libraries. You can pick from many different ones, [as described here](#). We recommend starting with the *All-in-one* container.
2. Next, choose a machine. If you scroll down to the bottom of the list, you'll see several free machines, with both CPUs and GPUs. Please pick any of them.
3. Start coding!



4] Use your Paperspace code to get your Springboard credits

We recommend that you start with Paperspace Free Tier, since we have an exclusive partnership with them. Once you are ready to use your credits, please do the following.

- Go to the top right corner, click on the person-shaped icon and click **Billing**



- Scroll down to Promo Code and enter your code. You should see your credits in your account

Promo Code

Promo Code

Note: currently only one promo code can be active per team.

5] Which Gradient Tier should you upgrade to?

By default, you'll be on the Gradient Free Tier. Depending on the needs of your project, you might want to stay there as long as possible. When you're ready to use your credits, you may upgrade to the G1 or G2 tiers. Note that you'll be spending your credits when you upgrade, so please choose wisely. We assume that the G1 tier will suffice for most students.

Individuals

Teams

| | | | |
|--|--|---|--|
| <h3>FREE</h3> <p>Beginner</p> <p>For hobbyists, explorers, and adventurous learners</p> <p>\$0/mo</p> <hr/> <p>Free + Low Instance Types</p> <hr/> <p>Public Notebooks</p> <hr/> <p>5GB Persistent Storage</p> <hr/> <p>Auto-shutdown (6 Hour Limit)</p> <hr/> <p>Community Support</p> <hr/> <p>Total Notebooks: 5</p> <hr/> <p>Running Notebook limit: 1</p> <hr/> <p>Total Jobs: Unlimited</p> <hr/> <p>Running Job limit: 1</p> <hr/> <div>Get Started</div> | <h3>G1</h3> <p>Developer</p> <p>For ML/AI engineers, data scientists, and researchers</p> <p>\$8/mo</p> <hr/> <p>Free + Low-Mid Instance Types</p> <hr/> <p>Private Notebooks</p> <hr/> <p>200GB Persistent Storage</p> <hr/> <p>Auto-shutdown (Configurable)</p> <hr/> <p>Email Support</p> <hr/> <p>Total Notebooks: 10</p> <hr/> <p>Running Notebook limit: 5</p> <hr/> <p>Total Jobs: Unlimited</p> <hr/> <p>Running Job limit: 2</p> <hr/> <div>Get Started</div> | <h3>G2</h3> <p>Professional</p> <p>For professionals building applications at scale</p> <p>\$24/mo</p> <hr/> <p>Free + Low-High Instance Types</p> <hr/> <p>Private Notebooks</p> <hr/> <p>1TB Persistent Storage</p> <hr/> <p>Auto-shutdown (Configurable)</p> <hr/> <p>Email Support</p> <hr/> <p>Total Notebooks: 50</p> <hr/> <p>Running Notebook limit: 10</p> <hr/> <p>Total Jobs: Unlimited</p> <hr/> <p>Running Job limit: 5</p> <hr/> <div>Get Started</div> | <h3>Enterprise</h3> <p>Gradient for Enterprise helps you build and deploy models on your own infrastructure. Contact Sales to learn more about production-grade tools and security controls for your organization.</p> <hr/> <p>On-prem, cloud, or hybrid</p> <hr/> <p>Training + Interface</p> <hr/> <p>Any data source</p> <hr/> <p>Native Kubernetes support</p> <hr/> <p>Priority Support</p> <hr/> <div>Contact Sales</div> |
|--|--|---|--|

6] Create a Paperspace team and add your mentor

We recommend that you keep your capstone project public, so you can share it easily with both your mentor as well as potential employers.

If you really want to keep it private and just share with your mentor, you need to create a team.

1. Go to <http://www.paperspace.com/console/teams>
2. Click on Create Team and create a new team
3. Invite your mentor to the team using their email address

7] Create a new Paperspace project

When you are ready to work on your own project.

1. Go to <https://www.paperspace.com/console/projects>
2. Click on Create Project
3. In the popup, choose Standalone Project

Documentation for [Gradient Projects](#)

8] What to do if you get stuck

If you get stuck while figuring out Paperspace, please refer to the documentation first. If that doesn't work, please feel free to use the *Need Help?* window on the bottom right of any page on the site.

Other cloud providers

As a reminder, we strongly recommend that you use Paperspace. However, if you want to try out some of the other cloud providers, here are some options.

GCP (Free tier)

Google Cloud Platform (GCP) provides a [free tier](#), where anyone can sign up and get \$300 of free credits. The free tier provides a mixture of the following:

- Tools that are always free (with limitations on amount of resources)
- Tools with a time-limited free trial, beyond which you have to spend your credits

- \$300 of free credits to be used for any GCP resource or tools

Limitations

- Obviously, there are limitations on how much you can use the tools, and it's up to you to ensure that you don't exceed usage limitations
- You'll have to figure out how to set up each tool on your own, and what combination of tools you might need
- You have to put in your credit card information and keep track of any charges that you might eventually incur.

It's not practical for us to document all of the available tools on GCP in this document, but you can find [detailed documentation here](#) about the various resources and constraints.

Azure (Free tier + \$100)

Similar to GCP, Microsoft Azure also provides a [free tier](#), which provides a mix of the following:

- Tools that are always free
- Tools that are free for 12 months (with resource constraints)
- \$200 of free credits towards any Azure resources for 30 days

In addition, Springboard partnered with Microsoft Azure to provide our students with an additional \$100 of free Azure credits. If you're interested in using Azure for your Capstone project, you'll be prompted in the curriculum to send an email to the student support team, who'll set you up.

We recommend using the additional \$100 credits only after exhausting all of the free resources that the Azure free tier provides to prototype your application.

AWS (Free tier + \$50)

Amazon Web Services (AWS) is the original cloud platform. Similar to GCP and Azure, AWS also provides a [free tier](#). The free tier provides a mixture of the following:

- Tools that are always free (with limitations on amount of resources)
- Tools with a 12-month free trial
- Shorter-term free trials



For students who need more resources, Springboard has partnered with AWS via their AWS Educate program to **offer every student \$50 of AWS credits**. You should receive an email from AWS Educate to claim your credits within two weeks from the date your course starts. Please contact [your student advisor](#) if you haven't received your AWS Educate email after two weeks of your course start date.

It's not practical for us to document all of the available AWS tools in this document, but you can find [FAQs here](#) about the various resources and how to use them.

We recommend prototyping your application as much as possible using the free tier, and only then spending your \$50 AWS Educate credits.

MLaaS Platforms

Having machines, processors and storage in the cloud is great, but it still means that you'd have to figure out all of the logistics of installing tools and managing machines for implementing your ML/DL programs. Fortunately, there are many Machine-Learning-as-a-Service (MLaaS) platforms built on top of these cloud services. Some of them are made by the cloud provider themselves, while others are third-party tools.

| Which cloud? | MLaaS Platform | Appropriate for? | Free or Needs credits? | Available resources |
|---------------------------|---------------------------------------|------------------|------------------------|---|
| Paperspace (Preferred) | Gradient (Free tier) | Prototyping | Free | 5 GB storage, CPU/GPU, auto-shutdown |
| | Gradient (With credits) | Full Project | Needs credits | All resources available with credits |
| GCP | Colab | Prototyping | Free | CPU, 1 GPU, Jupyter notebooks, ~350GB storage, ML libraries |
| | Datalab | Full Project | Needs credits | All resources available with credits |
| Azure | ML Studio | Full Project | Needs credits | All resources available with credits |
| AWS | Sagemaker | Full Project | Needs credits | All resources available with credits |
| | Domino (Student tier) | Prototyping | Free | CPU, Jupyter notebooks, ~50 GB storage, ML libraries |

Summary of MLaaS tools available to Springboard students

Paperspace Gradient

The Gradient platform from Paperspace is **our recommended platform** for both prototyping your project, as well as your final Capstone project. In addition, we'll recommend a few other resources in this section.

The Paperspace Gradient free tier includes CPUs and GPUs but have restrictions around machine usage and storage. From [their documentation](#):

- Notebooks will automatically shutdown after 6 hours per session
 - There are currently no limits to the number of sessions you can run
- All Notebooks (and Jobs coming soon) will be set to public and cannot be set to private
- 5GB of [persistent storage](#) is included for free — this cannot be expanded

Note: We are currently offering a limited pool of free instances so your notebook may be Pending in the queue as you wait for a free instance to become available. If you need immediate access to machines, please consider upgrading to a paid subscription plan.

Once you reach the point where the free tier doesn't work for your needs, please feel free to use your promo code and upgrade to the **G1 paid tier**. However, remember that you'll be using your credits to pay the monthly fee, as well as the resource usage fees!

For Prototyping

In addition to Paperspace Gradient, there are some other platforms out there you can use for prototyping.

Google Colaboratory

[Google's Colaboratory](#) (aka Colab) tool provides a Jupyter environment for prototyping Machine Learning applications in Python. It provides some really awesome FREE facilities that should be enough for most Capstone Project:

- CPU + GPU
- 350GB of disk storage
- 13GB of RAM
- Interfaces directly with Google Drive and Github
- Install Python packages on the underlying system as you need

Limitations

- Colab is a prototyping tool, not a deployment one. It's good for research, not necessarily for deployment
- Can't save customized containers containing specific new libraries or tools
- No way to upgrade to a paid tier or better hardware configurations; what you see is what you get

Some documentation

- [Documentation for Google Colab.](#)
- [Run your Python scripts on Google Colab](#)
- [PySpark on Google Colab](#)

Domino Data Lab (Student Tier)

[Domino Data Lab](#) is a popular Data Science and Machine Learning development platform that enables collaboration in Data Science teams. In this course, we use Domino for hosting our

mini-projects, and some students also use Domino for their Capstone Projects. Students have indefinite free access to Domino's student tier.

Domino's student tier provides a containerized environment with several useful features:

- Python 2.7 or a Python 3.6 environment
- Common ML libraries such as scikit-learn, Tensorflow, Keras and Spark/SparkML
- Facilities to easily deploy an application with an API

Limitations

- Suitable only for data sets up to ~50GB. Beyond that, Domino encourages using their Data Sets feature which is not enabled in the student tier.
- Some other Domino features may not be available in the student tier
- Can't create customized environment (by installing custom libraries, for example)
- Only CPU, no GPU

[Documentation for Domino](#)

For a deployed final project

In addition to Paperspace, there are a few platforms you can deploy your final project on, in case you really want to try them out. We highly recommend sticking to Paperspace and taking advantage of the free credits you have.

Google Cloud Datalab

[Google Cloud Datalab](#) lets you train, deploy and monitor ML/DL models on GCP on top of its [Cloud ML Engine](#). It provides a lot of built-in facilities to host your trained model in the cloud and simplify a machine learning workflow.

Note that when you use Datalab or Cloud ML Engine, you'll need to spend your free GCP credits on training and prediction, so remember to use only what you need and shut down instances when you're done with them! This [pricing guide](#) will help you estimate your resource consumption.

- [How to run a Notebook for Data Science on Google Cloud with a Database and a GPU in 15min](#)
- [Classification of Signature and Text images using CNN and Deploying the model on Google Cloud ML Engine](#)

Azure ML Studio

[Azure ML Studio](#) is Azure's managed ML platform. It provides both a free and paid tier. The free tier has several limitations, but might be useful for prototyping. The differences between the two tiers are [described here](#).

- [Predicting gas prices using Azure ML Studio](#)
- [How Microsoft Azure ML Studio clarifies Data Science](#)

AWS SageMaker

Similar to Cloud ML Engine, AWS provides its own ML/DL model management and deployment tool called [AWS SageMaker](#). As of the current time, Amazon provides 250 hours free of AWS SageMaker use on a non-GPU system. If you want to go beyond that time frame or use a GPU, you'll need to spend your AWS credits.

- [Build, Train, and Deploy a Machine Learning Model with AWS SageMaker](#)
- [Building fully custom machine learning models on AWS SageMaker: a practical guide](#)

How can you best conserve your cloud resources?

Cloud resources can sometimes feel very abstract, given that so much of our life nowadays runs 'in the cloud'. We constantly use email, social media and storage that rely on massive amounts of data stored in the cloud and transported to and from our devices. It's easy to forget that all this has a cost.

As future Machine Learning Engineers, we insist that you learn how to conserve cloud resources for three important reasons:

1. **Costs matter to employers:** Cloud resources can add up in cost really quickly. An MLE who can get a product working with fewer and efficiently used resources is much, much more valuable than one who cannot. Most employers will not provide unlimited resources, so you have to learn to work under constraints and within budget.
2. **It'll help you stand out in the job search:** A candidate who can demonstrate a clear understanding of how cloud platforms work, how they price their offerings, and shows

awareness of how to estimate resource consumption, will stand out in their job hunt as a more responsible and mature engineer.

- 3. It's good for the world:** Cloud resources ultimately consume a huge amount of energy; chips work on electricity and data centers need to be cooled. It's good for the environment and the planet not to waste energy in general.

So what are some ways you can be smart about the resources you use? We provide a few suggestions.

1] Prototype and test on your local machine first

It's easy to look at a large data set and think that you need to start in the cloud right away with a powerful CPU, one or more GPUs and a humongous amount of data storage. But do you really need that at an early stage? Think (and discuss with your mentor) about how you can make the most of your local machine. Laptops and desktops nowadays are enormously powerful, with multi-core CPUs, plenty of RAM and disk storage.

2] Use free cloud tools before you start using your credits

Once you have exhausted the possibility of your laptop, consider using some of the free prototyping tools available, as well as the free tier provided by your chosen cloud provider. You'll find that you can go a long way towards testing your prototype before firing it up on huge data sets.

3] Use smaller instances before trying larger ones

Try using less powerful CPUs/GPUs first, with subsets of your data if necessary. This will help you stay within the free tiers of various cloud providers. If you're using up credits on Paperspace or other cloud providers, this will help you burn your credits more slowly.

4] ALWAYS shut down your unused instances

The biggest source of wastage in cloud usage are unnecessarily running instances of machines. ALWAYS remember to shut down an instance when you're not using it. If this is an instance you're using free credits or paying for, it could burn through your wallet. And even if it's a resource you're using for free, it's important to be a good citizen of the cloud and develop good engineering habits. Your future managers and colleagues will thank you for it.

Paperspace has a default of 6 hours for its free tier. If you're using credits, you can change that to a value that's suitable for your project.

Conclusion

There are a variety of tools provided by the cloud providers in the market, and new tools are added all the time. In this document, we have made a few recommendations based on our conversations with employers and hiring managers, taking into account the resource constraints that you'll have to work under.

Overall, here's the strategy that we strongly recommend for your Capstone Projects:

1. First, use your local machine as much as possible to prototype
2. Then, use the prototyping tools that are available, such as the Gradient Student Tier, Google Colab, and Domino Student Tier.
3. Then, use all the free tier cloud resources you have access to for prototyping
4. Finally, use your available credits on Paperspace or other cloud providers for your deployed project. *Paperspace is our preferred provider.*

You're welcome to combine these resources in any way that makes sense to you and your mentor. For example, it's perfectly acceptable to use free computation resources from Paperspace combined with paid storage on AWS S3 buckets.

Remember to work closely with your mentor to pick the options that are right for you.

Unfortunately, once you run out of these options, Springboard will be unable to cover you any more. You're welcome to pay for using more cloud resources at that point.

Before we conclude, we'd like to leave you with three takeaways.

1] Keep your deployment architecture as simple as possible

Building and deploying an ML/DL application is hard. While it's tempting to do everything perfectly and get into the weeds so you can show off your skills, it's impossible to learn everything that's out there in such a short amount of time. Use the tools, services and platforms that will get you to your goals and your project done as quickly as possible.

2] Prototype first on smaller and cheaper resources

Yes, we know. You want to run your fancy Deep Learning algorithm on the Terabyte of data you've acquired, and use 16 GPUs to do it. But please prototype and experiment on your own machine, or on a smaller cloud system first. Use the free resources available before spending your valuable credits.

3] When you're not using a cloud instance, **TURN.IT.OFF.**

