

Configuration Manual

MSc Research Project MSc Cloud Computing

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MSc Project Submission Sheet

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Student ID:	Masters in Cloud Computing		2023
Programme:		Year:	
Module:	MSc Research project		_
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Lecturer:	-		
Submission Due Date:	16-09-2024		
Project Title:	Using Machine Learning in Edge Computing Scheduling	g for Opti	imizing Resource
	315		
Word Count:	Page Count:	, 	

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Signature:	16-09-2024
Date:	

PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST

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Configuration Manual

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1 Introduction

Below is the configuration manual for the research carried out under the topic "Using Machine Learning in Edge Computing for Optimizing Resource Scheduling". There are three areas covered i.e., Environmental Setup, Tools Setup and Information on the dataset used in this research.

2 Environmental Setup

Below is the Hardware Setup for finding the best model in the local environment Processor: Intel i3 or above Memory: 8 GB RAM Below is the Programming Setup Python Programming Version 3.10 and above

3 Tools Setup

There are two tools required for this project and a dataset

- Anaconda Navigator: For creation of the predictive Model
- AWS Cloud EC2 Instance
- Dataset (Link mentioned in section 3.3)

3.1 Installing Anaconda Navigator

Step 1: Download Anaconda Navigator from the below link https://www.anaconda.com/download

Step 2: Install Anaconda Navigator by following the below instructions



Step 3: Open Anaconda Navigator

	All applications v on	base (root)				
onments	P	Ô	O °	¢ jupyter	¢ IP(y)	
ing	PyCharm Professional	Anaconda Toolbox	Anaconda Cloud Notebooks	Notebook	Qt Console	
nunity	A full-fledged IDE by JetBrains for both Scientific and web Python development. Supports HTML, JS, and SQL	0.4.0 Anaconda Assistant JupyterLab supercharged with a suite of Anaconda extensions, starting with the Anaconda Assistant At chatbot.	Cloud-hosted notebook service from Anaconda. Launch a preconfigured environment with hundreds of packages and store project files with persistent cloud storage.	7.06 Web-based, interactive computing notebook environment. Edit and run human-readable docs while describing the data analysis.	P 5.4.2 PyQt GUI that supports inline figures, proper multiline editing with syntax highlighting, graphical calitips, and more.	
	Install	Install	Launch	Launch	Launch	
	Spyder 2 433 Seterific Photo Development Revinored registron of betty refunding interpretent interpretent	VS Code US Code 1.87 Streamlined code editor with support for development control.	Anaconda on AWS Graviton Anaconda on AWS Graviton Bunning your Anaconda workloads on AWS Graviton based processors could provide up to 40% better price performance	Concernent	Clueviz Clueviz 1.2.4 Multidimensional data sisualization across files. Explore relationships within and among related datasets.	
	Launch	Launch	Launch	Launch	Install	
la Toolbox arged abooks. Toolbox tall.	¢ JupyterLab	Crange 3				
nentation	An extensible environment for interactive and reproducible computing, based on the	Component based data mining framework. Data visualization and data analysis for				

Step 4: Launch Jupyter Notebook

O Anaconda Navigator			- 🗆 X
<u>File H</u> elp			
	DA NAVIGATOR		Sign in to Anaconda Cloud
A Home	Applications on base (root)	 ✓ Channels 	Refresh
Environments	*	¢	^
单 Learning	lab	Jupyter	
Community	JupyterLab	Notebook	
	0.35.4	5.7.8	
	An extensible environment for interactive and reproducible computing, based on the	Web-based, interactive computing notebook environment. Edit and run human-readable	
Documentation	Jupyter Notebook and Architecture.	docs while describing the data analysis.	
Developer Blog	Launch	Launch	
¥ <u>You</u> 👼			~
	Launching notebook		

Step 5: Use any browser to launch Jupyter Notebook



Step 6: Open the jupyter notebooks from the source code and run the cells one by one. Note first run the notebook named '1-Network Load Balancing Data Preparation.ipynb' and then run '2-Building ML Models.ipynb' and finally run '3-fusion models.ipynb'.

3.2 AWS Cloud – EC2 Instance

For creation of the EC2 Instance, Login to the AWS Cloud, Narrow down to EC2 Instance and Setup accordingly. Create security group and ports 22, 80, 443 and 8080. Remember to save your key pair.

aws		
Sign in		
Root user Account owner that performs tasks requiring unrestricted access. Learn more IAM user User within an account that performs daily tasks. Learn more	Control gen Al costs	erative
Root user email address	Increase generative Al	
username@example.com	performance and reduced to the second reduce	
Next	costs with these rour.	
By continuing, you agree to the AWS Customer Agreement or other agreement for AWS services, and the Privacy Notice. This site uses essential cookies. See our Cookie Notice for more information	Learn more >	
New to AWS?		
EC2 > Instances > Launch an instance		▼ Summary
Launch an instance Info		Number of instances Info
Amazon EC2 allows you to create virtual machines, or instances, tha following the simple steps below.	t run on the AWS Cloud. Quickly get started by	1
Name and tags Info		Software Image (AMI) Amazon Linux 2023 AMI 2023.5.2read more ami-05c3dc660cb6907f0
Name		Virtual server type (instance type)
edge_resource_scheduler	Add additional tags	t2.micro
• Application and OS Imagos (Amazon Mashino		Firewall (security group) New security group
Application and OS images (Amazon Machine	inage) into	Storage (volumes)
An AMI is a template that contains the software configuration (o applications) required to launch your instance. Search or Browse below	perating system, application server, and for AMIs if you don't see what you are looking for	Free tier: In your first year includes X 750 hours of 21 micro (or 15 micro in
Q Search our full catalog including 1000s of application and 05	5 images	
		Cancel Launch instance

Network Info		▼ Summary
vpc-02b3dd537e0f3d664		
Subnet Info		Number of instances Info
No preference (Default subnet in any availability zone)		1
Auto-assign public IP		
Enable		Software Image (AMI)
Additional charges apply when outside of free tier allowa	nce	Amazon Linux 2023 AMI 2023.5.2read more
Firewall (security groups)		am-oscacoocosovio
A security group is a set of firewall rules that control the traffic instance.	or your instance. Add rules to allow specific traffic to reach your	Virtual server type (instance type) t2.micro
• Create security group	Firewall (security group)	
We'll create a new security group called 'launch-wizard	I-3' with the following rules:	New security group
Allow SSH traffic from		Storage (volumes)
Helps you connect to your instance 0.0.0.0/0	•	1 volume(s) - 8 GiB
Allow HTTPS traffic from the internet		
To set up an endpoint, for example when creating a web ser	ver	Free tier: In your first year includes
Allow HTTP traffic from the internet		750 hours of t2.micro (or t3.micro in
To set up an endpoint, for example when creating a web ser	ver	
Instances (1/1) Info	Connect Instant	ce state V Actions V Launch instances V
Q Find Instance by attribute or tag (case-sensitive)	All state	25 ▼ < 1 > ③
✓ Name 🖉 🔻 Instance ID	Instance state ∇ Instance type ∇ Sta	atus check Alarm status Availability Zone 🔻
dge_resource i-02951070266e12543	⊗ Running ® Q t2.micro ⊘	2/2 checks passec View alarms + us-east-2a
i-02951070266e12543 (edge_resource_sc	heduler) =	@ ×
Details Status and alarms Monitoring	Security Networking Storage Tags	
Instance summary Info		
Instance ID	Public IPv4 address	Private IPv4 addresses
☐ i-02951070266e12543 (edge_resource_scheduler)	🗇 13.58.216.224 open address 🖸	□ 172.31.11.34
IDuG address	Instance state	Public IPv4 DNS
IPVO address	Instance state	

Instance state ⊘ Running

-

Hostname type

Private IP DNS name (IPv4 only) auto intornal Public IPv4 DNS

ð ec2-13-58-216-224.us-east-2.compute.amazonaws.com | open address 🔀

Security details			
· security declars			
AM Role	Owner ID	Launch time	
_5	D 471112533959	Sat Aug 03 2024 (02:03:29 GMT+05
		(India Standard Ti	me)
Security groups			
đ			
sg-0c30d92801715f924 (launch-			
wizard-1)			
wizard-1)			
wizard-1) Inbound rules			
wizard-1) ▼ Inbound rules			
 ▼ Inbound rules Q Filter rules 			< 1 >
 ✓ Inbound rules Q. Filter rules Name 	Security group rule ID	Port range	< 1 > Protocol
 ✓ Inbound rules Q. Filter rules Name 	Security group rule ID sgr-0aa19896d8cb9f87f	Port range	│ < 1 > │ Protocol TCP
 vizard-1) ✓ Inbound rules Q. Filter rules Name - - 	Security group rule ID sgr-0aa19896d8cb9f87f sgr-0ecdf4cc5414211f7	Port range 22 80	<pre> < 1 > Protocol TCP TCP</pre>
vizard-1) Inbound rules Q. Filter rules Name - <td>Security group rule ID sgr-0aa19896d8cb9f87f sgr-0ecdf4cc5414211f7 sgr-0e0b71d8433514d8b</td> <td>Port range 22 80 443</td> <td>CP CP CP CP CP</td>	Security group rule ID sgr-0aa19896d8cb9f87f sgr-0ecdf4cc5414211f7 sgr-0e0b71d8433514d8b	Port range 22 80 443	CP CP CP CP CP

In your terminal change the permissions of the pem file

sudo chmod 600 ./ key_pair.pem

Secure Copy the edge_computing_predictor.py file and the '.sav' file into the instance

scp -i "key_pair.pem" edge_computing_predictor.py instance_dns_url:~
scp -i "key_pair.pem" AdaBoostClassifier.sav instance_dns_url:~

SSH into the instance and install the required packages

, #	Amonon 1.4					
~~	Amazon LI	nux 2023				
~~ \###						
~~	https://a	ws.amazon.com/linux/amazor	n-linux-2023			
~~ V~''->						
~~~ /						
_/m/'						
[ec2-user@ip-172-31-	14-104 ~]\$	sudo yum install python-p	oip			
Last metadata expira	tion check	: 0:03:08 ago on Fri Aug	2 20:34:17 2024.			
Dependencies resolve	a. ==========					
Package	Arch	Version	Repository	Size		
Installing:						
nython3-nin	noarch	21.3.1-2.amzn2023.0.7	amazonlinux	1.8 M		
Installing weak depe	ndencies:					
libxcrypt-compat	x86_64	4.4.33-7.amzn2023	amazonlinux	92 k		
Transaction Summary						
Install 2 Packages						
Total download size:	1 0 М					
Installed size: 11 M	2.7 %					
[ec2-user@in-172-3	1-14-194	~1\$ nin install bottle	ioblib nandas so	cikit-lea	Th	
Defaulting to user	installa	tion because normal sit	e-packages is no	ot writea	ble	
Collecting bottle			o puonugoo io ni			
Downloading bott	le-0.12.2	5-py3-none-any.whl (90	kB)			
		90 kB 3.4	MB/s			
Collecting joblib	200 C					
Downloading jobl	ib-1.4.2-	py3-none-any.whl (301 k	B)			
		301 kB 5.4	MB/s			
Collecting pandas						
Downloading pand	as-2.2.2-	cp39-cp39-manylinux_2_1	/_x86_64.manylin	nux2014_x	86_64.wh1 (13.1 M	8)
Collecting soikit-	loarn	13.1 MB /	4 MD/S			
Downloading scik	it learn-	1.5.1-cn39-cn39-manylin	ux 2 17 x86 64 r	manvlinuv	2014 x86 64 whl (	13.4 MB)
l	10_100111	13.4 MB 37	.5 MB/s	indiry 12110x	2014_x00_04.001 (	2014 1107
Collecting numpy>=	1.22.4					
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		19.5 MB 29	.2 MB/s			
Requirement alread	y satisfi	ed: pytz>=2020.1 in /us	r/lib/python3.9,	/site-pac	kages (from panda	s) (2022.7.1)
Collecting tzdata>	=2022.7					
Downloading tzda	ta-2024.1	-py2.py3-none-any.whl (	345 kB)			
		345 kB 45.	3 MB/s			
Collecting python-	dateutil>	=2.8.2		00 1.03		
Downloading pyth	on_dateut	11-2.9.0.post0-py2.py3-	none-any.whl (22	29 KB)		
		229 KB 51.	L MB/S			

Run the API file

#### python3 edge_computing_predictor.py

Open a new terminal to build the UI but before that change the instance url in the app.py file

```
# Define the URL of the API endpoint
api_url = 'http://ec2-13-58-216-224.us-east-2.compute.amazonaws.com:8080/resource-scheduling'
# Send POST request
response = requests.post(api_url, headers={'Content-Type': 'application/json'}, json=data)
response_data = response.json() # Assuming the response is JSON
# Extract server ID from response
server_id = response_data.get('server_id', 'Not available')
return render_template('output.html', server_id=server_id, data=response_data)
if __name__ == '__main__':
    app.run(debug=True, host='0.0.0.0', port=8080)
```





#### 3.3 Dataset

The dataset is downloaded from the below link: <u>https://www.kaggle.com/datasets/omarsobhy14/5g-quality-of-</u> <u>service?select=Quality+of+Service+5G.csv</u>

## 4 References

https://aws.amazon.com/ https://www.anaconda.com/download https://scikit-learn.org/stable/user_guide.html