Phase 1 Engine Documentation

The purpose of this documentation is to demonstrate the steps a user should take to successfully use the Engine, as well as interpret the outputs of the Engine. This documentation is for any potential user of the Engine. **The engine uses the Multilabel MLP**.

Instructions

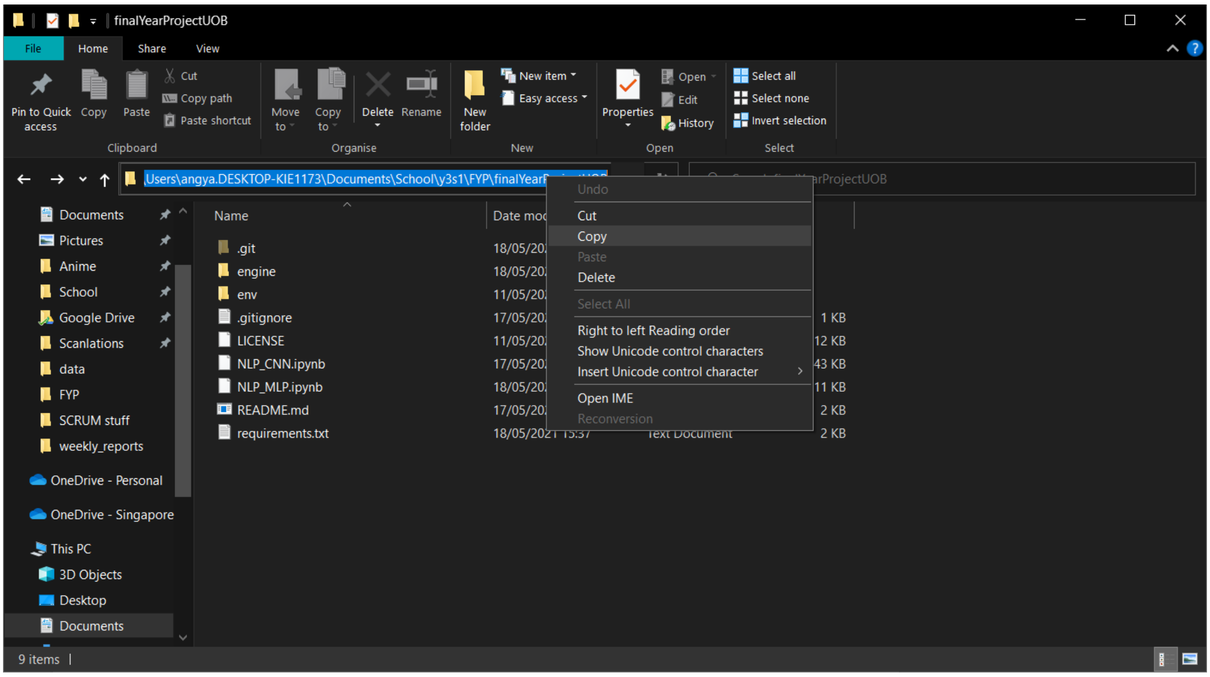
1. Download and unzip project zip file: “*fyp_code_vX*”, where *vX* is the version number.

   1.1. Please ensure the folder has the following content before proceeding:

   A. Engine
      - __pycache__
      - files
      - weights
      - app.py
      - predict.py
      - preprocess.py
      - sector_master_definition.xlsx

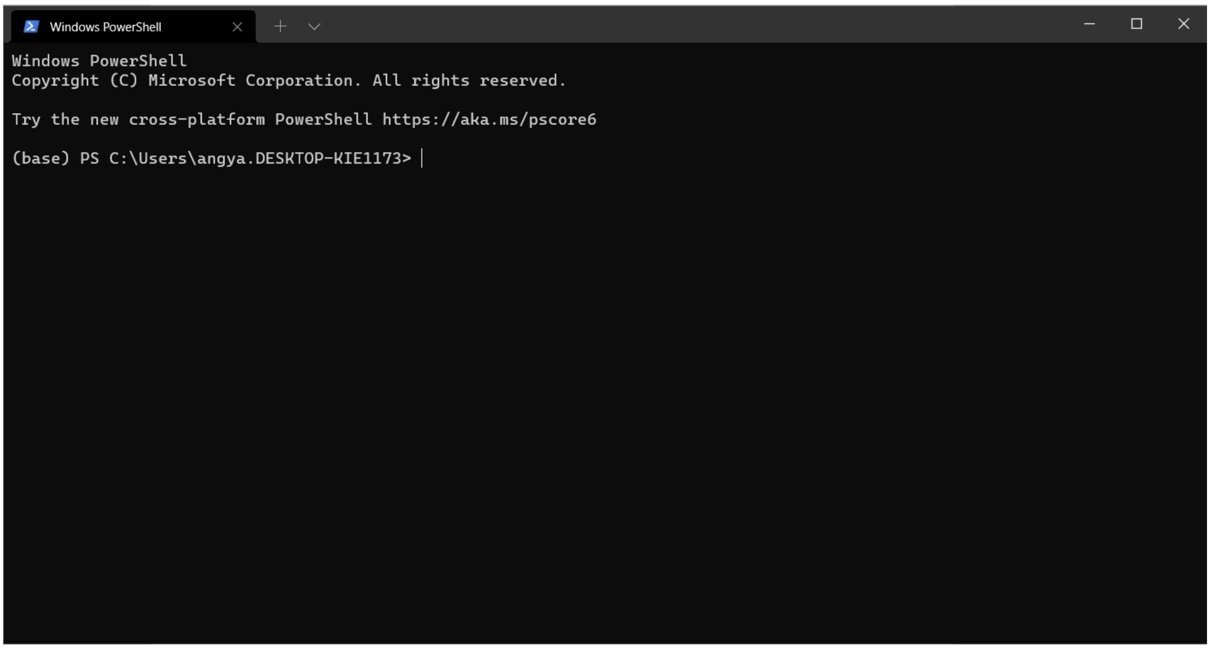
   B. .gitignore
   C. LICENSE
   D. NLP_CNN.ipynb
   E. NLP_MLP.ipynb
   F. README.md
   G. requirements.txt

2. Navigate into unzipped project folder on your file explorer.
3. Copy path to project folder as such:



Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYear

4. Open Anaconda Prompt or Powershell.



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

(base) PS C:\Users\angya.DESKTOP-KIE1173> |
```
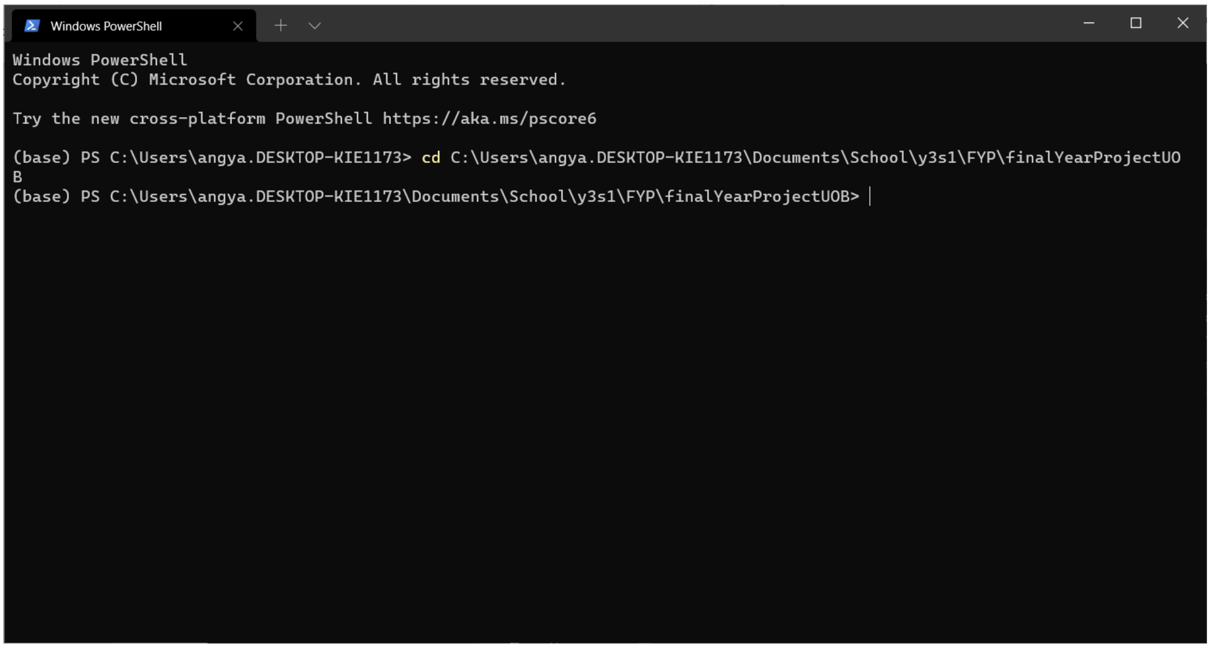

5. Run `cd <project_path>`, where `<project_path>` is replaced with the copied path from the previous step.



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

(base) PS C:\Users\angya.DESKTOP-KIE1173> cd C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUO
B
(base) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> |
```
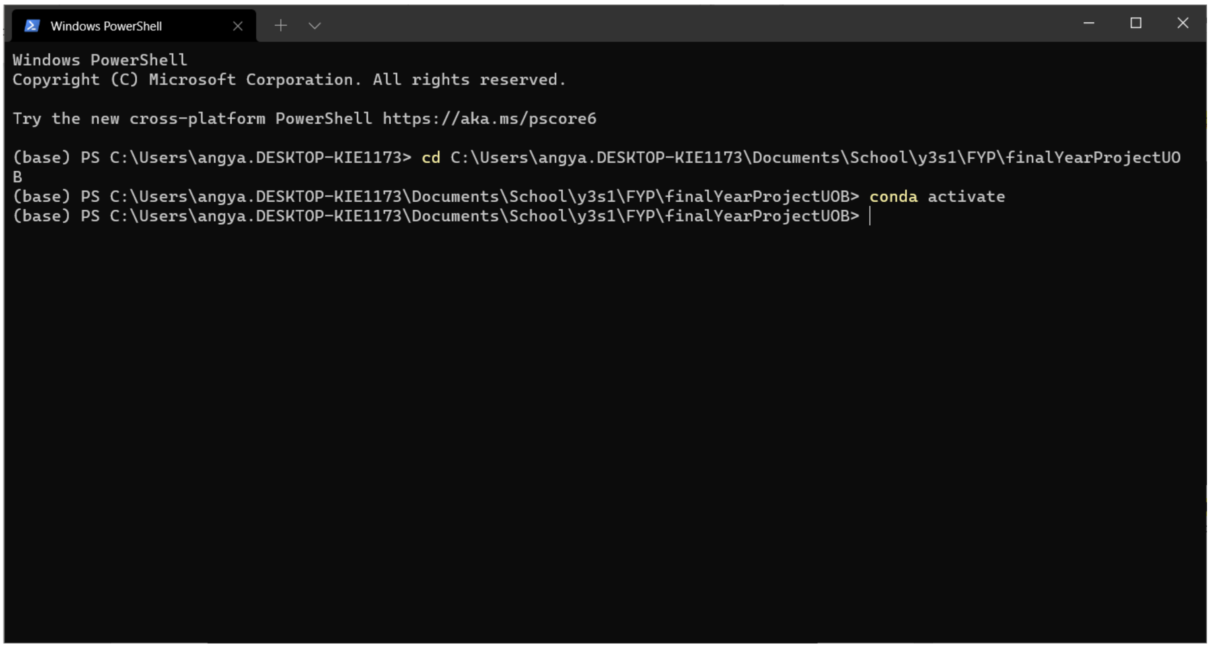

6. Run `conda activate` to ensure that the Anaconda environment is enabled. (There should be a (base) visible if it is enabled)



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

(base) PS C:\Users\angya.DESKTOP-KIE1173> cd C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUO
B
(base) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> conda activate
(base) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB>
```
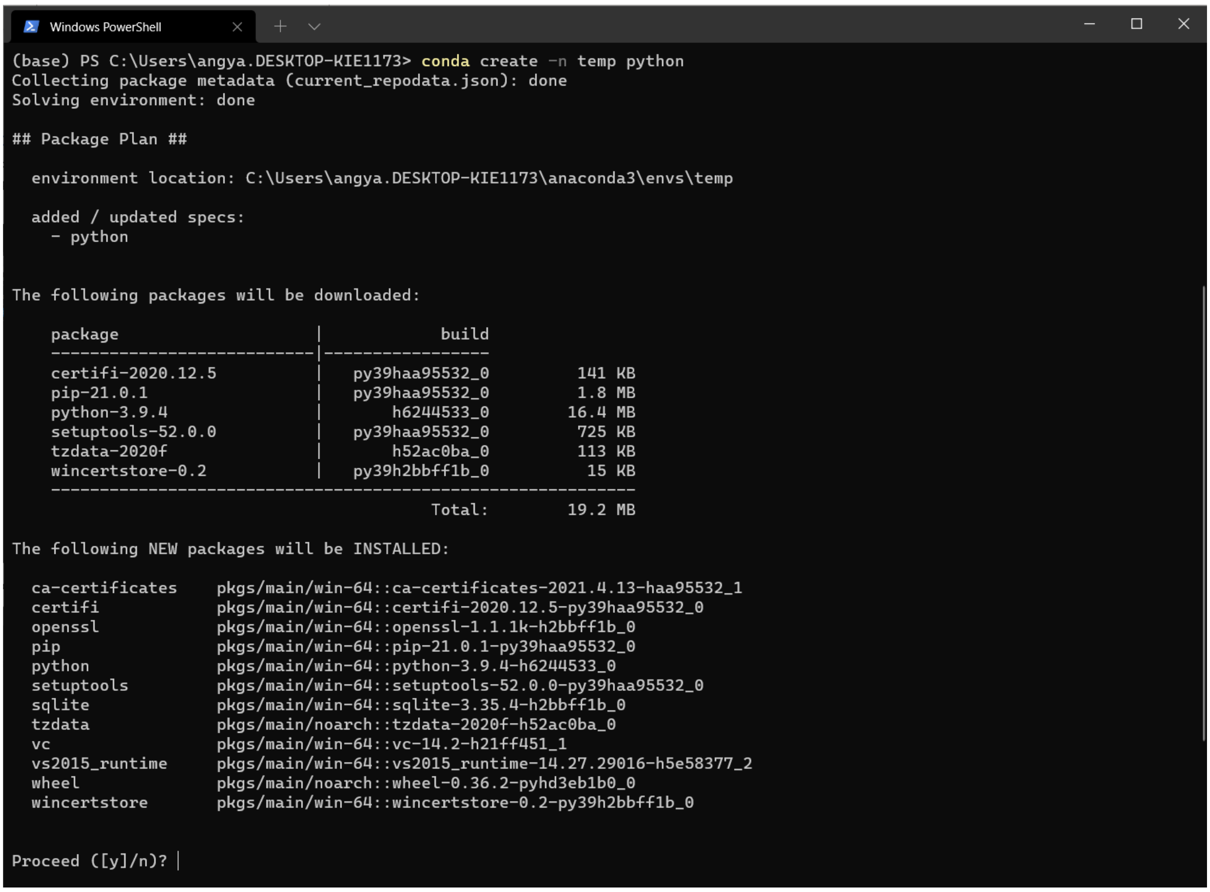
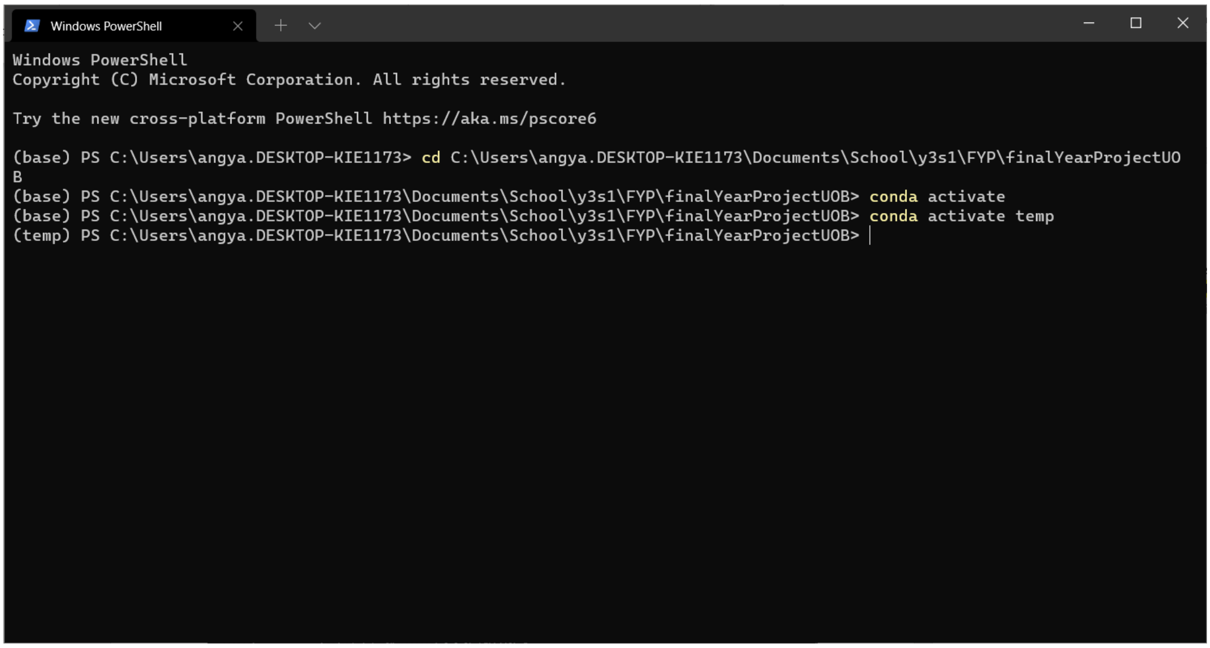

DISCLAIMER: PLEASE RUN STEP 7 TO 10 IF NVIDIA CUDNN PACKAGE IS NOT INSTALLED IN YOUR DEVICE BEFORE. ONLY RUN IF YOUR DEVICE HAS AN NVIDIA GPU.

7. OPTIONAL: Run `conda create -n temp python` to create a fresh conda environment, so that your default anaconda environment is not dirtied with the libraries required to run the code. Press `y` then `Enter` when prompted.



```
(base) PS C:\Users\angya.DESKTOP-KIE1173> conda create -n temp python
Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: C:\Users\angya.DESKTOP-KIE1173\anaconda3\envs\temp

  added / updated specs:
    - python


The following packages will be downloaded:

    package                    |            build
    ---------------------------|-----------------
    certifi-2020.12.5          |   py39haa95532_0         141 KB
    pip-21.0.1                 |   py39haa95532_0         1.8 MB
    python-3.9.4               |       h6244533_0        16.4 MB
    setuptools-52.0.0          |   py39haa95532_0         725 KB
    tzdata-2020f               |       h52ac0ba_0         113 KB
    wincertstore-0.2           |   py39h2bbff1b_0          15 KB
    ------------------------------------------------------------
                                           Total:        19.2 MB

The following NEW packages will be INSTALLED:

  ca-certificates    pkgs/main/win-64::ca-certificates-2021.4.13-haa95532_1
  certifi            pkgs/main/win-64::certifi-2020.12.5-py39haa95532_0
  openssl            pkgs/main/win-64::openssl-1.1.1k-h2bbff1b_0
  pip                pkgs/main/win-64::pip-21.0.1-py39haa95532_0
  python             pkgs/main/win-64::python-3.9.4-h6244533_0
  setuptools         pkgs/main/win-64::setuptools-52.0.0-py39haa95532_0
  sqlite             pkgs/main/win-64::sqlite-3.35.4-h2bbff1b_0
  tzdata             pkgs/main/noarch::tzdata-2020f-h52ac0ba_0
  vc                 pkgs/main/win-64::vc-14.2-h21ff451_1
  vs2015_runtime     pkgs/main/win-64::vs2015_runtime-14.27.29016-h5e58377_2
  wheel              pkgs/main/noarch::wheel-0.36.2-pyhd3eb1b0_0
  wincertstore       pkgs/main/win-64::wincertstore-0.2-py39h2bbff1b_0


Proceed ([y]/n)?
```

8. OPTIONAL: Wait until the setup is complete.
9. OPTIONAL: Run `conda activate temp` to activate the created anaconda environment. (There should be a (temp) visible if it is successfully enabled)



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

(base) PS C:\Users\angya.DESKTOP-KIE1173> cd C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUO
B
(base) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> conda activate
(base) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> conda activate temp
(temp) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB>
```
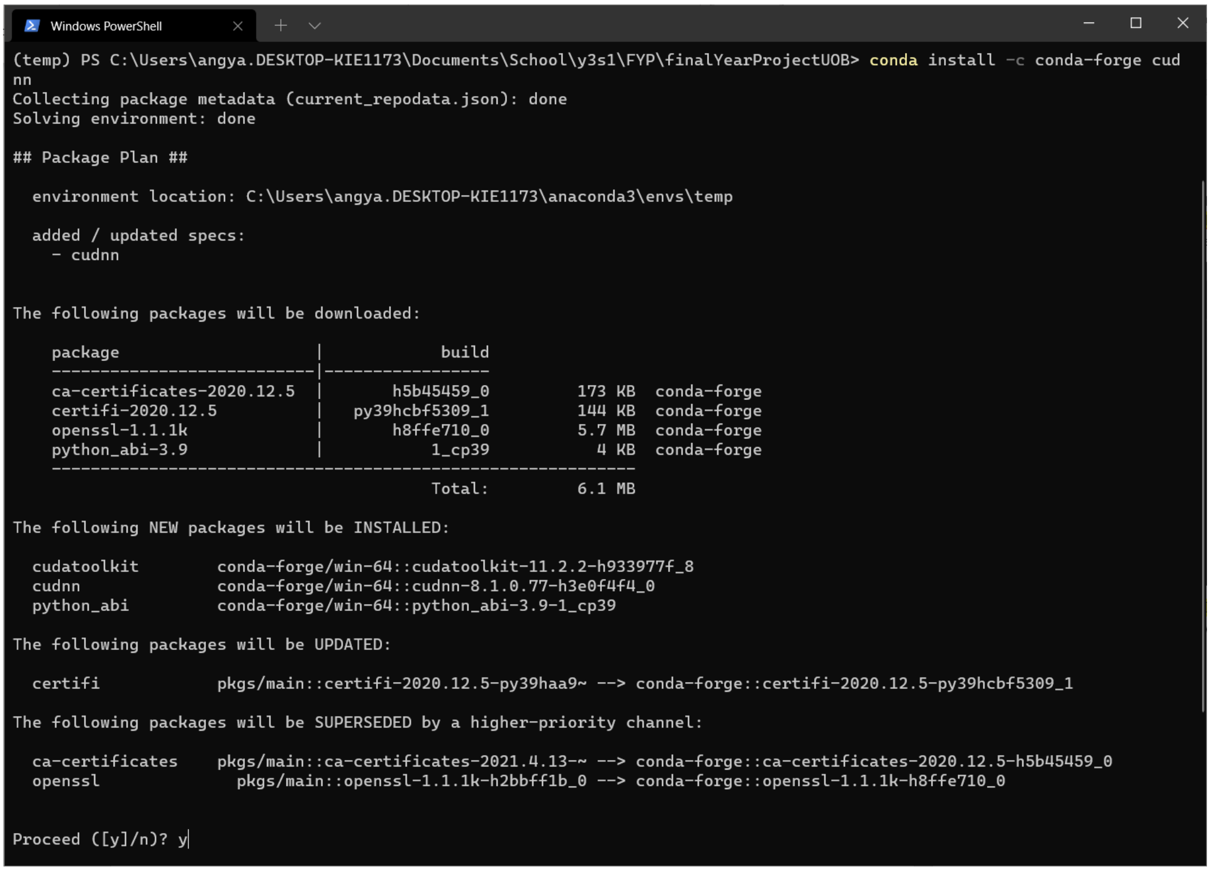
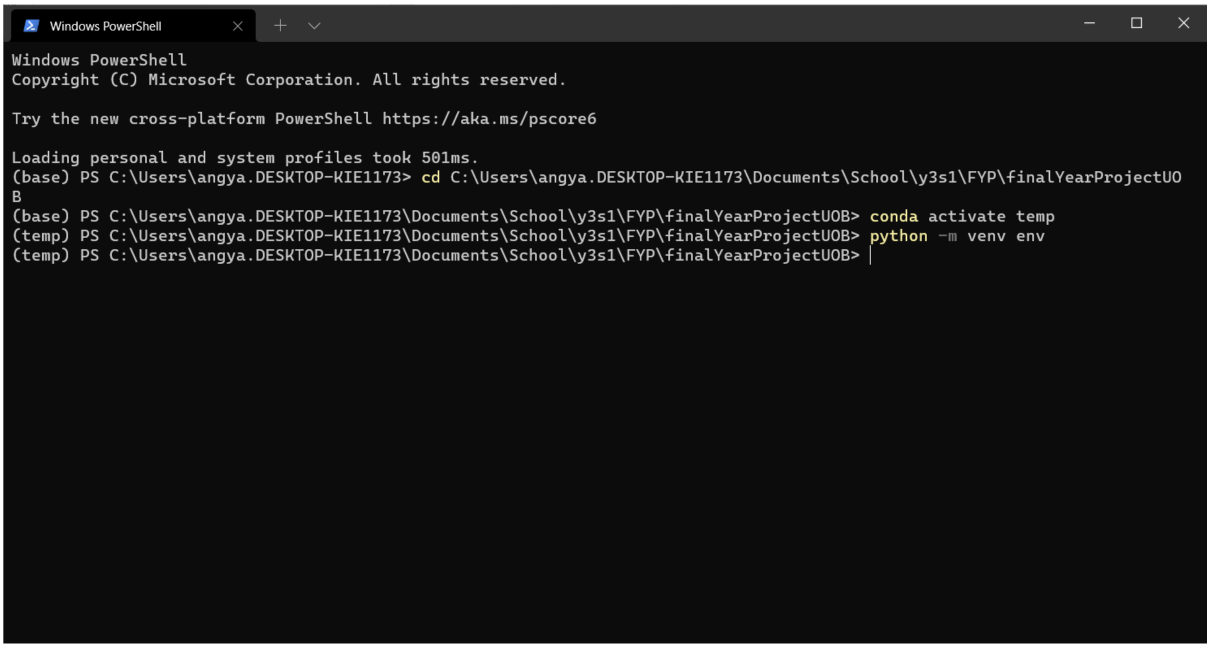

10. OPTIONAL: Run `conda install -c conda-forge cudnn` to install libraries required for GPU usage. Press `y` then `Enter` when prompted. Wait for installation to complete.



```
(temp) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> conda install -c conda-forge cud
nn
Collecting package metadata (current_repodata.json): done
Solving environment: done

## Package Plan ##

  environment location: C:\Users\angya.DESKTOP-KIE1173\anaconda3\envs\temp

  added / updated specs:
    - cudnn


The following packages will be downloaded:

    package                    |            build
    ---------------------------|-----------------
    ca-certificates-2020.12.5  |       h5b45459_0         173 KB  conda-forge
    certifi-2020.12.5          |   py39hcbf5309_1         144 KB  conda-forge
    openssl-1.1.1k             |       h8ffe710_0         5.7 MB  conda-forge
    python_abi-3.9             |           1_cp39           4 KB  conda-forge
    ------------------------------------------------------------
                                           Total:         6.1 MB

The following NEW packages will be INSTALLED:

  cudatoolkit        conda-forge/win-64::cudatoolkit-11.2.2-h933977f_8
  cudnn              conda-forge/win-64::cudnn-8.1.0.77-h3e0f4f4_0
  python_abi         conda-forge/win-64::python_abi-3.9-1_cp39

The following packages will be UPDATED:

  certifi            pkgs/main::certifi-2020.12.5-py39haa9~ --> conda-forge::certifi-2020.12.5-py39hcbf5309_1

The following packages will be SUPERSEDED by a higher-priority channel:

  ca-certificates    pkgs/main::ca-certificates-2021.4.13-~ --> conda-forge::ca-certificates-2020.12.5-h5b45459_0
  openssl              pkgs/main::openssl-1.1.1k-h2bbff1b_0 --> conda-forge::openssl-1.1.1k-h8ffe710_0


Proceed ([y]/n)? y
```

11. Run `python -m venv env` to make a new python virtual environment. This is to ensure that the installed python libraries do not dirty your python environment, and that there are no conflicts with existing packages that can cause the Engine to fail.



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

Loading personal and system profiles took 501ms.
(base) PS C:\Users\angya.DESKTOP-KIE1173> cd C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUO
B
(base) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> conda activate temp
(temp) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> python -m venv env
(temp) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB>
```
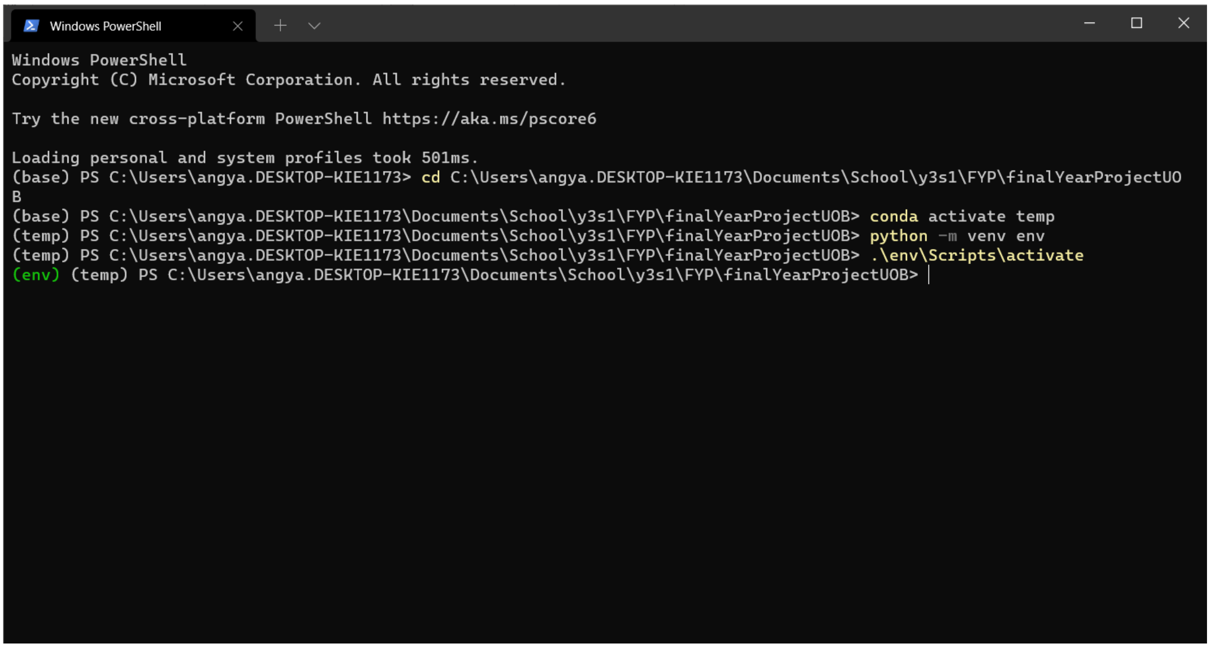

12. Run `.\env\Scripts\activate` to activate the created python virtual environment. (There should be a (env) visible.)



```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

Loading personal and system profiles took 501ms.
(base) PS C:\Users\angya.DESKTOP-KIE1173> cd C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUO
B
(base) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> conda activate temp
(temp) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> python -m venv env
(temp) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> .\env\Scripts\activate
(env) (temp) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB>
```
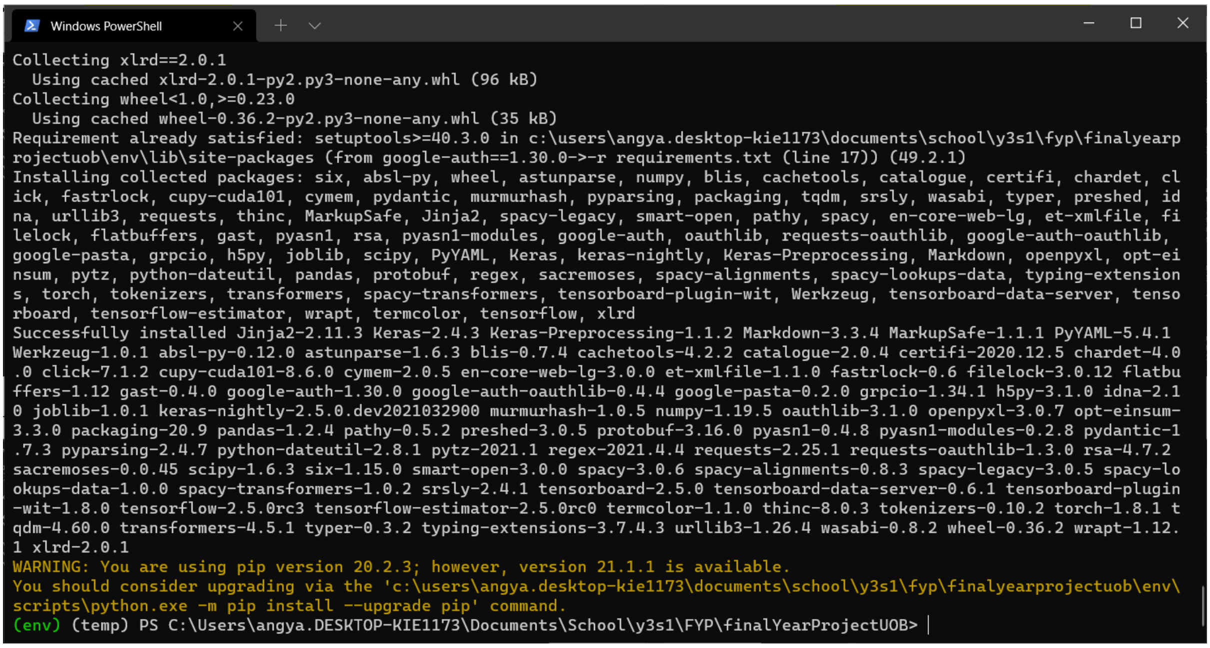
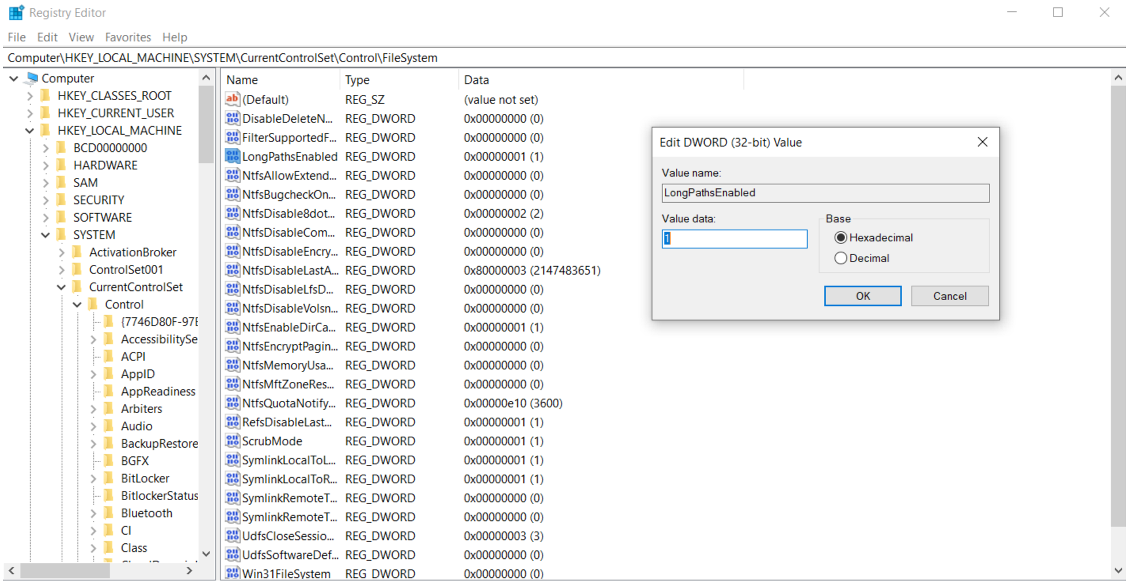

13. Run `pip install -r requirements.txt` to install required libraries. Wait for installation to finish.



```
Collecting xlrd==2.0.1
  Using cached xlrd-2.0.1-py2.py3-none-any.whl (96 kB)
Collecting wheel<1.0,>=0.23.0
  Using cached wheel-0.36.2-py2.py3-none-any.whl (35 kB)
Requirement already satisfied: setuptools>=40.3.0 in c:\users\angya.desktop-kie1173\documents\school\y3s1\fyp\finalyearp
rojectuob\env\lib\site-packages (from google-auth==1.30.0->-r requirements.txt (line 17)) (49.2.1)
Installing collected packages: six, absl-py, wheel, astunparse, numpy, blis, cachetools, catalogue, certifi, chardet, cl
ick, fastrlock, cupy-cuda101, cymem, pydantic, murmurhash, pyparsing, packaging, tqdm, srsly, wasabi, typer, preshed, id
na, urllib3, requests, thinc, MarkupSafe, Jinja2, spacy-legacy, smart-open, pathy, spacy, en-core-web-lg, et-xmlfile, fi
lelock, flatbuffers, gast, pyasn1, rsa, pyasn1-modules, google-auth, oauthlib, requests-oauthlib, google-auth-oauthlib,
google-pasta, grpcio, h5py, joblib, scipy, PyYAML, Keras, keras-nightly, Keras-Preprocessing, Markdown, openpyxl, opt-ei
nsum, pytz, python-dateutil, pandas, protobuf, regex, sacremoses, spacy-alignments, spacy-lookups-data, typing-extension
s, torch, tokenizers, transformers, spacy-transformers, tensorboard-plugin-wit, Werkzeug, tensorboard-data-server, tenso
rboard, tensorflow-estimator, wrapt, termcolor, tensorflow, xlrd
Successfully installed Jinja2-2.11.3 Keras-2.4.3 Keras-Preprocessing-1.1.2 Markdown-3.3.4 MarkupSafe-1.1.1 PyYAML-5.4.1
Werkzeug-1.0.1 absl-py-0.12.0 astunparse-1.6.3 blis-0.7.4 cachetools-4.2.2 catalogue-2.0.4 certifi-2020.12.5 chardet-4.0
.0 click-7.1.2 cupy-cuda101-8.6.0 cymem-2.0.5 en-core-web-lg-3.0.0 et-xmlfile-1.1.0 fastrlock-0.6 filelock-3.0.12 flatbu
ffers-1.12 gast-0.4.0 google-auth-1.30.0 google-auth-oauthlib-0.4.4 google-pasta-0.2.0 grpcio-1.34.1 h5py-3.1.0 idna-2.1
0 joblib-1.0.1 keras-nightly-2.5.0.dev2021032900 murmurhash-1.0.5 numpy-1.19.5 oauthlib-3.1.0 openpyxl-3.0.7 opt-einsum-
3.3.0 packaging-20.9 pandas-1.2.4 pathy-0.5.2 preshed-3.0.5 protobuf-3.16.0 pyasn1-0.4.8 pyasn1-modules-0.2.8 pydantic-1
.7.3 pyparsing-2.4.7 python-dateutil-2.8.1 pytz-2021.1 regex-2021.4.4 requests-2.25.1 requests-oauthlib-1.3.0 rsa-4.7.2
sacremoses-0.0.45 scipy-1.6.3 six-1.15.0 smart-open-3.0.0 spacy-3.0.6 spacy-alignments-0.8.3 spacy-legacy-3.0.5 spacy-lo
okups-data-1.0.0 spacy-transformers-1.0.2 srsly-2.4.1 tensorboard-2.5.0 tensorboard-data-server-0.6.1 tensorboard-plugin
-wit-1.8.0 tensorflow-2.5.0rc3 tensorflow-estimator-2.5.0rc0 termcolor-1.1.0 thinc-8.0.3 tokenizers-0.10.2 torch-1.8.1 t
qdm-4.60.0 transformers-4.5.1 typer-0.3.2 typing-extensions-3.7.4.3 urllib3-1.26.4 wasabi-0.8.2 wheel-0.36.2 wrapt-1.12.
1 xlrd-2.0.1
WARNING: You are using pip version 20.2.3; however, version 21.1.1 is available.
You should consider upgrading via the 'c:\users\angya.desktop-kie1173\documents\school\y3s1\fyp\finalyearprojectuob\env\
scripts\python.exe -m pip install --upgrade pip' command.
(env) (temp) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> |
```

14. OPTIONAL: If you encounter an OS error saying that the package could not be installed as there is no such file or directory when running the above command, it is most likely due to the file path being too long. To solve this, search up Registry Editor in your search bar and copy paste this path into the search bar of the Registry Editor found at the top: "Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\FileSystem". Then, right click on "LongPathsEnabled" and change the "Value data" from 0 to 1. After this, you must close the Powershell or Anaconda Prompt, delete the env folder and restart from the very beginning.

** Please do note if you are worried that this step might affect your file system in the future, you can change it back to 0 after running the engine**



Computer\HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\FileSystem

Name	Type	Data
(Default)	REG_SZ	(value not set)
DisableDeleteN...	REG_DWORD	0x00000000 (0)
FilterSupportedF...	REG_DWORD	0x00000000 (0)
LongPathsEnabled	REG_DWORD	0x00000001 (1)
NtfsAllowExtend...	REG_DWORD	0x00000000 (0)
NtfsBugcheckOn...	REG_DWORD	0x00000000 (0)
NtfsDisable8dot...	REG_DWORD	0x00000002 (2)
NtfsDisableCom...	REG_DWORD	0x00000000 (0)
NtfsDisableEncry...	REG_DWORD	0x00000000 (0)
NtfsDisableLastA...	REG_DWORD	0x80000003 (2147483651)
NtfsDisableLfsD...	REG_DWORD	0x00000000 (0)
NtfsDisableVolsn...	REG_DWORD	0x00000000 (0)
NtfsEnableDirCa...	REG_DWORD	0x00000001 (1)
NtfsEncryptPagin...	REG_DWORD	0x00000000 (0)
NtfsMemoryUsa...	REG_DWORD	0x00000000 (0)
NtfsMftZoneRes...	REG_DWORD	0x00000000 (0)
NtfsQuotaNotify...	REG_DWORD	0x00000e10 (3600)
RefsDisableLast...	REG_DWORD	0x00000001 (1)
ScrubMode	REG_DWORD	0x00000001 (1)
SymlinkLocalToL...	REG_DWORD	0x00000001 (1)
SymlinkLocalToR...	REG_DWORD	0x00000001 (1)
SymlinkRemoteT...	REG_DWORD	0x00000000 (0)
SymlinkRemoteT...	REG_DWORD	0x00000000 (0)
UdfsCloseSessio...	REG_DWORD	0x00000003 (3)
UdfsSoftwareDef...	REG_DWORD	0x00000000 (0)
Win31FileSystem	REG_DWORD	0x00000000 (0)

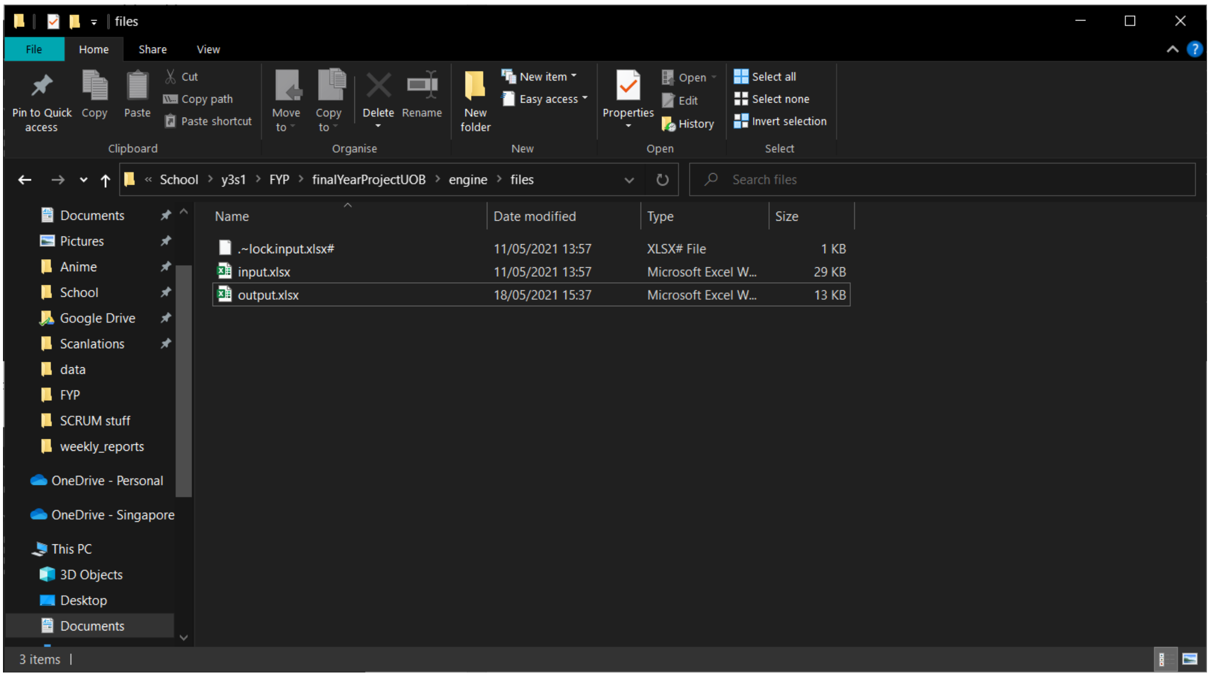
Edit DWORD (32-bit) Value

Value name: LongPathsEnabled

Value data: 1

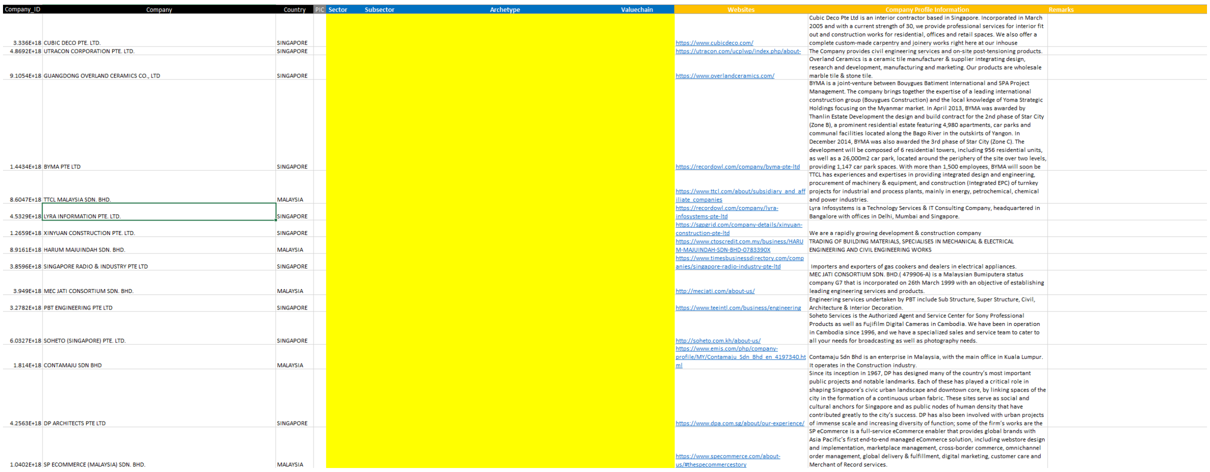
Base: ● Hexadecimal ○ Decimal

15. Ensure that there is an “input.xlsx” in the folder `/engine/files` in the project folder. An “output.xlsx” is optional.



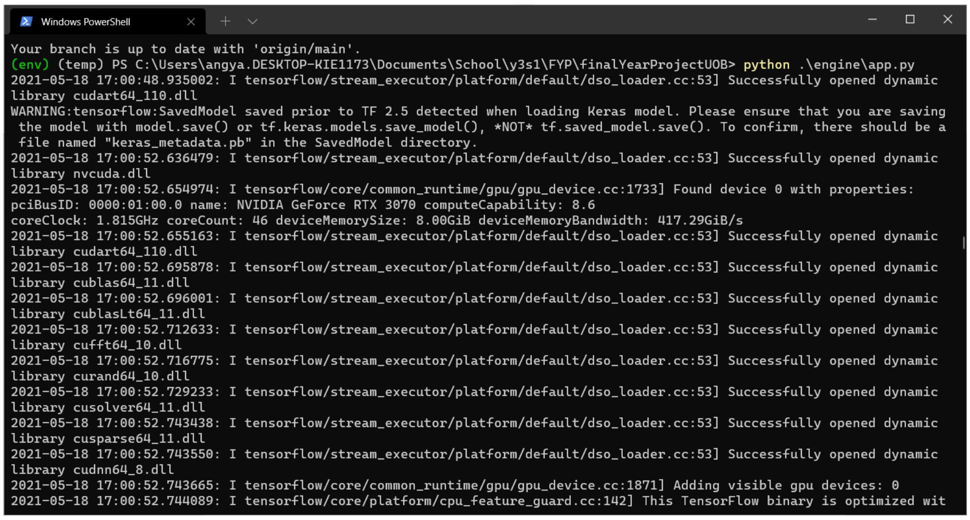
Name	Date modified	Type	Size
.~lock.input.xlsx#	11/05/2021 13:57	XLSX# File	1 KB
input.xlsx	11/05/2021 13:57	Microsoft Excel W...	29 KB
output.xlsx	18/05/2021 15:37	Microsoft Excel W...	13 KB

16. OPTIONAL: If you want to create a custom input file, do follow format of the already existing “input.xlsx” file, and make sure that the custom file is in `/engine/files`. (If the file contains invalid entries, it will be automatically removed and will not show up in the “output.xlsx” file)

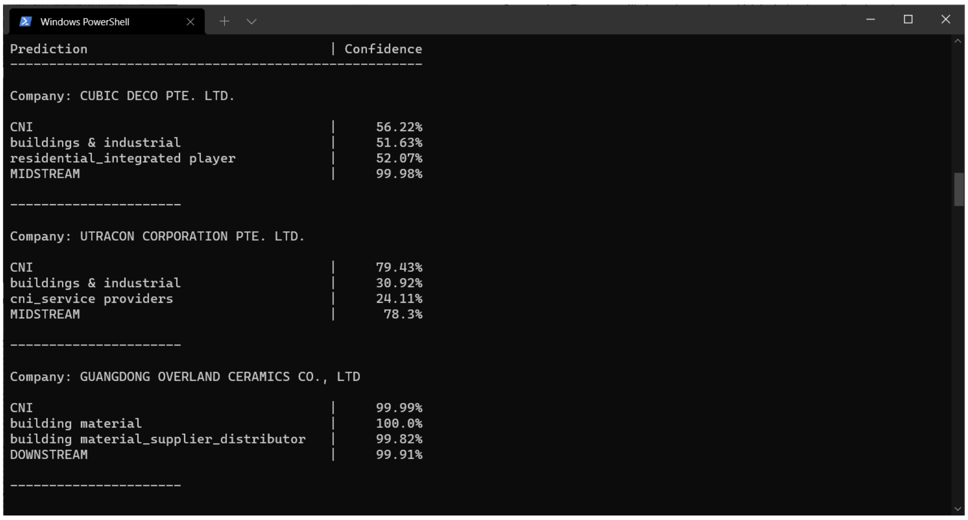


Company_ID	Company	Country	PIC	Sector	Subsector	Archetype	Valuechain	Websites	Company Profile Information	Remarks
3.336E+18	CUBIC DECO PTE. LTD.	SINGAPORE						https://www.cubicdeco.com/	Cubic Deco Pte Ltd is an interior contractor based in Singapore. Incorporated in March 2005 and with a current strength of 30, we provide professional services for interior fit out and construction works for residential, offices and retail spaces. We also offer a complete custom-made carpentry and joinery works right here at our inhouse	
4.8692E+18	UTRACON CORPORATION PTE. LTD.	SINGAPORE						https://utracon.com/ucplwp/index.php/about-	The Company provides civil engineering services and on-site post-tensioning products.	
9.1054E+18	GUANGDONG OVERLAND CERAMICS CO., LTD	SINGAPORE						https://www.overlandceramics.com/	Overland Ceramics is a ceramic tile manufacturer & supplier integrating design, research and development, manufacturing and marketing. Our products are wholesale marble tile & stone tile.	
1.4434E+18	BYMA PTE LTD	SINGAPORE						https://recordowl.com/company/byma-pte-ltd	BYMA is a joint-venture between Bouygues Batiment International and SPA Project Management. The company brings together the expertise of a leading international construction group (Bouygues Construction) and the local knowledge of Yoma Strategic Holdings focusing on the Myanmar market. In April 2013, BYMA was awarded by Thanlin Estate Development the design and build contract for the 2nd phase of Star City (Zone B), a prominent residential estate featuring 4,980 apartments, car parks and communal facilities located along the Bago River in the outskirts of Yangon. In December 2014, BYMA was also awarded the 3rd phase of Star City (Zone C). The development will be composed of 6 residential towers, including 956 residential units, as well as a 26,000m2 car park, located around the periphery of the site over two levels, providing 1,147 car park spaces. With more than 1,500 employees, BYMA will soon be	
8.6047E+18	TTCL MALAYSIA SDN. BHD.	MALAYSIA						https://www.ttcl.com/about/subsidiary_and_affiliate_companies	TTCL has experiences and expertises in providing integrated design and engineering, procurement of machinery & equipment, and construction (Integrated EPC) of turnkey projects for industrial and process plants, mainly in energy, petrochemical, chemical and power industries.	
4.5329E+18	LYRA INFORMATION PTE. LTD.	SINGAPORE						https://recordowl.com/company/lyra-infosystems-pte-ltd	Lyra Infosystems is a Technology Services & IT Consulting Company, headquartered in Bangalore with offices in Delhi, Mumbai and Singapore.	
1.2659E+18	XINYUAN CONSTRUCTION PTE. LTD.	SINGAPORE						https://sgpgrid.com/company-details/xinyuan-construction-pte-ltd	We are a rapidly growing development & construction company	
8.9161E+18	HARUM MAJUINDAH SDN. BHD.	MALAYSIA						https://www.ctoscredit.com.my/business/HARUM-MAJUINDAH-SDN-BHD-0783390X	TRADING OF BUILDING MATERIALS, SPECIALISES IN MECHANICAL & ELECTRICAL ENGINEERING AND CIVIL ENGINEERING WORKS	
3.8596E+18	SINGAPORE RADIO & INDUSTRY PTE LTD	SINGAPORE						https://www.timesbusinessdirectory.com/companies/singapore-radio-industry-pte-ltd	Importers and exporters of gas cookers and dealers in electrical appliances.	
3.949E+18	MEC JATI CONSORTIUM SDN. BHD.	MALAYSIA						http://mecjati.com/about-us/	MEC JATI CONSORTIUM SDN. BHD.(479906-A) is a Malaysian Bumiputera status company G7 that is incorporated on 26th March 1999 with an objective of establishing leading engineering services and products.	
3.2782E+18	PBT ENGINEERING PTE LTD	SINGAPORE						https://www.teeintl.com/business/engineering	Engineering services undertaken by PBT include Sub Structure, Super Structure, Civil, Architecture & Interior Decoration.	
6.0327E+18	SOHETO (SINGAPORE) PTE. LTD.	SINGAPORE						http://soheto.com.kh/about-us/	Soheto Services is the Authorized Agent and Service Center for Sony Professional Products as well as Fujifilm Digital Cameras in Cambodia. We have been in operation in Cambodia since 1996, and we have a specialized sales and service team to cater to all your needs for broadcasting as well as photography needs.	
1.814E+18	CONTAMAJU SDN BHD	MALAYSIA						https://www.emis.com/php/company-profile/MY/Contamaju_Sdn_Bhd_en_4197340.html	Contamaju Sdn Bhd is an enterprise in Malaysia, with the main office in Kuala Lumpur. It operates in the Construction industry.	
4.2563E+18	DP ARCHITECTS PTE LTD	SINGAPORE						https://www.dpa.com.sg/about/our-experience/	Since its inception in 1967, DP has designed many of the country’s most important public projects and notable landmarks. Each of these has played a critical role in shaping Singapore’s civic urban landscape and downtown core, by linking spaces of the city in the formation of a continuous urban fabric. These sites serve as social and cultural anchors for Singapore and as public nodes of human density that have contributed greatly to the city’s success. DP has also been involved with urban projects of immense scale and increasing diversity of function; some of the firm’s works are the	
1.0402E+18	SP ECOMMERCE (MALAYSIA) SDN. BHD.	MALAYSIA						https://www.specommerce.com/about-us/#thespecommercestory	SP eCommerce is a full-service eCommerce enabler that provides global brands with Asia Pacific’s first end-to-end managed eCommerce solution, including webstore design and implementation, marketplace management, cross-border commerce, omnichannel order management, global delivery & fulfillment, digital marketing, customer care and Merchant of Record services.	

17. To run the Engine, simply run `cd engine`, then `python app.py` in Powershell or Anaconda Prompt. Below is a partial snapshot of the terminal output.

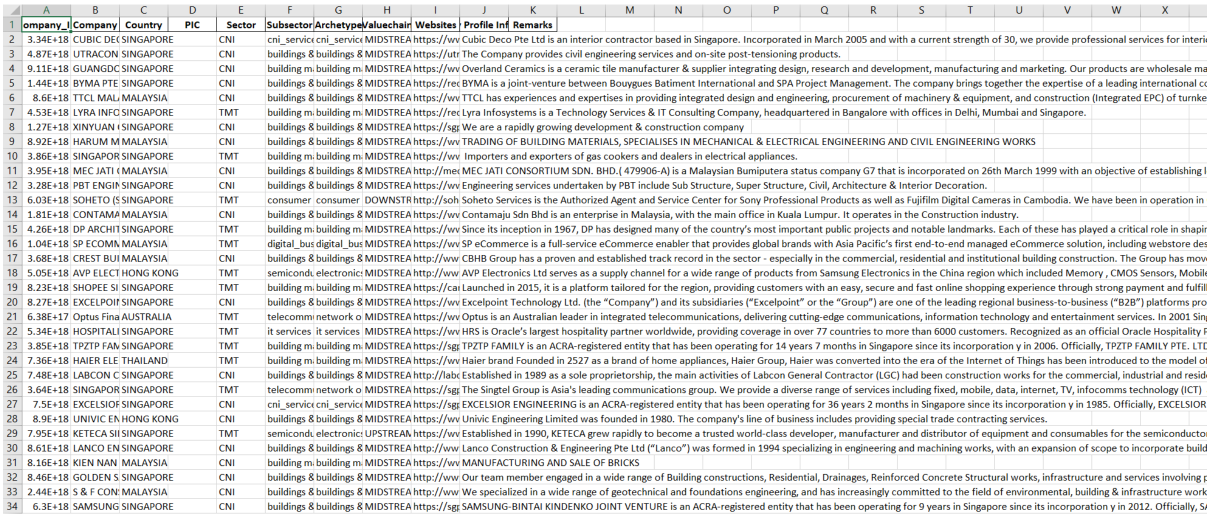


```
Your branch is up to date with 'origin/main'.
(env) (temp) PS C:\Users\angya.DESKTOP-KIE1173\Documents\School\y3s1\FYP\finalYearProjectUOB> python .\engine\app.py
2021-05-18 17:00:48.935002: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library cudart64_110.dll
WARNING:tensorflow:SavedModel saved prior to TF 2.5 detected when loading Keras model. Please ensure that you are saving
 the model with model.save() or tf.keras.models.save_model(), *NOT* tf.saved_model.save(). To confirm, there should be a
 file named "keras_metadata.pb" in the SavedModel directory.
2021-05-18 17:00:52.636479: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library nvcuda.dll
2021-05-18 17:00:52.654974: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1733] Found device 0 with properties:
pciBusID: 0000:01:00.0 name: NVIDIA GeForce RTX 3070 computeCapability: 8.6
coreClock: 1.815GHz coreCount: 46 deviceMemorySize: 8.00GiB deviceMemoryBandwidth: 417.29GiB/s
2021-05-18 17:00:52.655163: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library cudart64_110.dll
2021-05-18 17:00:52.695878: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library cublas64_11.dll
2021-05-18 17:00:52.696001: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library cublasLt64_11.dll
2021-05-18 17:00:52.712633: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library cufft64_10.dll
2021-05-18 17:00:52.716775: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library curand64_10.dll
2021-05-18 17:00:52.729233: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library cusolver64_11.dll
2021-05-18 17:00:52.743438: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library cusparse64_11.dll
2021-05-18 17:00:52.743550: I tensorflow/stream_executor/platform/default/dso_loader.cc:53] Successfully opened dynamic
library cudnn64_8.dll
2021-05-18 17:00:52.743665: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1871] Adding visible gpu devices: 0
2021-05-18 17:00:52.744089: I tensorflow/core/platform/cpu_feature_guard.cc:142] This TensorFlow binary is optimized wit
```



```
Prediction                                    | Confidence
-----------------------------------------------------------

Company: CUBIC DECO PTE. LTD.

CNI                                           |     56.22%
buildings & industrial                        |     51.63%
residential_integrated player                 |     52.07%
MIDSTREAM                                     |     99.98%

----------------------

Company: UTRACON CORPORATION PTE. LTD.

CNI                                           |     79.43%
buildings & industrial                        |     30.92%
cni_service providers                         |     24.11%
MIDSTREAM                                     |      78.3%

----------------------

Company: GUANGDONG OVERLAND CERAMICS CO., LTD

CNI                                           |     99.99%
building material                             |     100.0%
building material_supplier_distributor        |     99.82%
DOWNSTREAM                                    |     99.91%

----------------------
```

18. The output Excel file will be placed in the folder `/engine/files` and named "output.xlsx". Once opened, it will look like this:

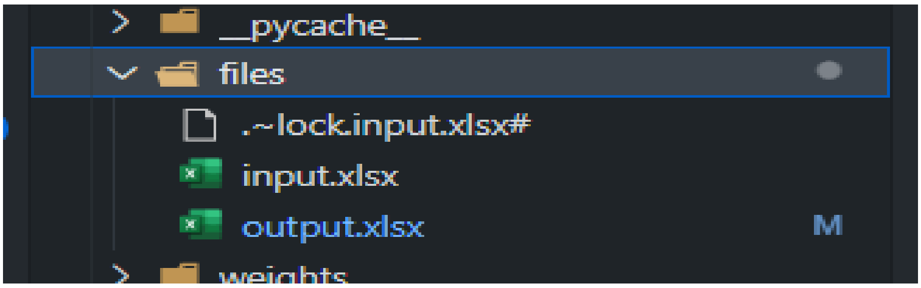


	A	B	C	D	E	F	G	H	I	J	K
1	ompany_I	Company	Country	PIC	Sector	Subsector	Archetype	Valuechain	Websites	Profile Inf	Remarks
2	3.34E+18	CUBIC DE(	SINGAPORE		CNI	cni_service	cni_service	MIDSTREA	https://wv	Cubic Deco Pte Ltd is an interior contractor based in Singapore. Incorporated in March 2005 and with a current strength of 30, we provide professional services for interi	
3	4.87E+18	UTRACON	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://utr	The Company provides civil engineering services and on-site post-tensioning products.	
4	9.11E+18	GUANGDC	SINGAPORE		CNI	building m	building m	MIDSTREA	https://wv	Overland Ceramics is a ceramic tile manufacturer & supplier integrating design, research and development, manufacturing and marketing. Our products are wholesale ma	
5	1.44E+18	BYMA PTE	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://rec	BYMA is a joint-venture between Bouygues Batiment International and SPA Project Management. The company brings together the expertise of a leading international cc	
6	8.6E+18	TTCL MAL	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	https://wv	TTCL has experiences and expertises in providing integrated design and engineering, procurement of machinery & equipment, and construction (Integrated EPC) of turnke	
7	4.53E+18	LYRA INFO	SINGAPORE		TMT	building m	building m	MIDSTREA	https://rec	Lyra Infosystems is a Technology Services & IT Consulting Company, headquartered in Bangalore with offices in Delhi, Mumbai and Singapore.	
8	1.27E+18	XINYUAN (	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://sgp	We are a rapidly growing development & construction company	
9	8.92E+18	HARUM M	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	https://wv	TRADING OF BUILDING MATERIALS, SPECIALISES IN MECHANICAL & ELECTRICAL ENGINEERING AND CIVIL ENGINEERING WORKS	
10	3.86E+18	SINGAPOR	SINGAPORE		TMT	building m	building m	MIDSTREA	https://wv	Importers and exporters of gas cookers and dealers in electrical appliances.	
11	3.95E+18	MEC JATI (	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	http://mec	MEC JATI CONSORTIUM SDN. BHD.(479906-A) is a Malaysian Bumiputera status company G7 that is incorporated on 26th March 1999 with an objective of establishing l	
12	3.28E+18	PBT ENGIN	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://wv	Engineering services undertaken by PBT include Sub Structure, Super Structure, Civil, Architecture & Interior Decoration.	
13	6.03E+18	SOHETO (S	SINGAPORE		TMT	consumer	consumer	DOWNSTR	http://soh	Soheto Services is the Authorized Agent and Service Center for Sony Professional Products as well as Fujifilm Digital Cameras in Cambodia. We have been in operation in	
14	1.81E+18	CONTAMA	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	https://wv	Contamaju Sdn Bhd is an enterprise in Malaysia, with the main office in Kuala Lumpur. It operates in the Construction industry.	
15	4.26E+18	DP ARCHIT	SINGAPORE		TMT	building m	building m	MIDSTREA	https://wv	Since its inception in 1967, DP has designed many of the country's most important public projects and notable landmarks. Each of these has played a critical role in shapir	
16	1.04E+18	SP ECOMN	MALAYSIA		TMT	digital_bus	digital_bus	MIDSTREA	https://wv	SP eCommerce is a full-service eCommerce enabler that provides global brands with Asia Pacific's first end-to-end managed eCommerce solution, including webstore des	
17	3.68E+18	CREST BUI	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	http://ww	CBHB Group has a proven and established track record in the sector - especially in the commercial, residential and institutional building construction. The Group has mov	
18	5.05E+18	AVP ELECT	HONG KONG		TMT	semicondu	electronics	MIDSTREA	http://ww	AVP Electronics Ltd serves as a supply channel for a wide range of products from Samsung Electronics in the China region which included Memory , CMOS Sensors, Mobile	
19	8.23E+18	SHOPEE SI	SINGAPORE		TMT	building m	building m	MIDSTREA	https://car	Launched in 2015, it is a platform tailored for the region, providing customers with an easy, secure and fast online shopping experience through strong payment and fulfill	
20	8.27E+18	EXCELPOII	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://wv	Excelpoint Technology Ltd. (the "Company") and its subsidiaries ("Excelpoint" or the "Group") are one of the leading regional business-to-business ("B2B") platforms pro	
21	6.38E+17	Optus Fina	AUSTRALIA		TMT	telecommı	network o	MIDSTREA	https://wv	Optus is an Australian leader in integrated telecommunications, delivering cutting-edge communications, information technology and entertainment services. In 2001 Sin	
22	5.34E+18	HOSPITALI	SINGAPORE		TMT	it services	it services	MIDSTREA	https://wv	HRS is Oracle's largest hospitality partner worldwide, providing coverage in over 77 countries to more than 6000 customers. Recognized as an official Oracle Hospitality F	
23	3.85E+18	TPZTP FAN	SINGAPORE		TMT	building m	building m	MIDSTREA	https://sgp	TPZTP FAMILY is an ACRA-registered entity that has been operating for 14 years 7 months in Singapore since its incorporation y in 2006. Officially, TPZTP FAMILY PTE. LTD	
24	7.36E+18	HAIER ELE	THAILAND		TMT	building m	building m	MIDSTREA	https://wv	Haier brand Founded in 2527 as a brand of home appliances, Haier Group, Haier was converted into the era of the Internet of Things has been introduced to the model of	
25	7.48E+18	LABCON C	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	http://labc	Established in 1989 as a sole proprietorship, the main activities of Labcon General Contractor (LGC) had been construction works for the commercial, industrial and reside	
26	3.64E+18	SINGAPOR	SINGAPORE		TMT	telecommı	network o	MIDSTREA	https://sgp	The Singtel Group is Asia's leading communications group. We provide a diverse range of services including fixed, mobile, data, internet, TV, infocomms technology (ICT)	
27	7.5E+18	EXCELSIOF	SINGAPORE		CNI	cni_service	cni_service	MIDSTREA	https://sgp	EXCELSIOR ENGINEERING is an ACRA-registered entity that has been operating for 36 years 2 months in Singapore since its incorporation y in 1985. Officially, EXCELSIOR	
28	8.9E+18	UNIVIC EN	HONG KONG		CNI	buildings &	buildings &	MIDSTREA	https://wv	Univic Engineering Limited was founded in 1980. The company's line of business includes providing special trade contracting services.	
29	7.95E+18	KETECA SII	SINGAPORE		TMT	semicondu	electronics	UPSTREAN	https://wv	Established in 1990, KETECA grew rapidly to become a trusted world-class developer, manufacturer and distributor of equipment and consumables for the semiconducto	
30	8.61E+18	LANCO EN	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	http://ww	Lanco Construction & Engineering Pte Ltd ("Lanco") was formed in 1994 specializing in engineering and machining works, with an expansion of scope to incorporate build	
31	8.16E+18	KIEN NAN	MALAYSIA		CNI	building m	building m	MIDSTREA	https://wv	MANUFACTURING AND SALE OF BRICKS	
32	8.46E+18	GOLDEN S	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	http://ww	Our team member engaged in a wide range of Building constructions, Residential, Drainages, Reinforced Concrete Structural works, infrastructure and services involving p	
33	2.44E+18	S & F CON	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	http://ww	We specialized in a wide range of geotechnical and foundations engineering, and has increasingly committed to the field of environmental, building & infrastructure work	
34	6.3E+18	SAMSUNG	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://sgp	SAMSUNG-BINTAI KINDENKO JOINT VENTURE is an ACRA-registered entity that has been operating for 9 years in Singapore since its incorporation y in 2012. Officially, SA	

19. To run the Engine with another Excel file, simply repeat steps 14 – 18.

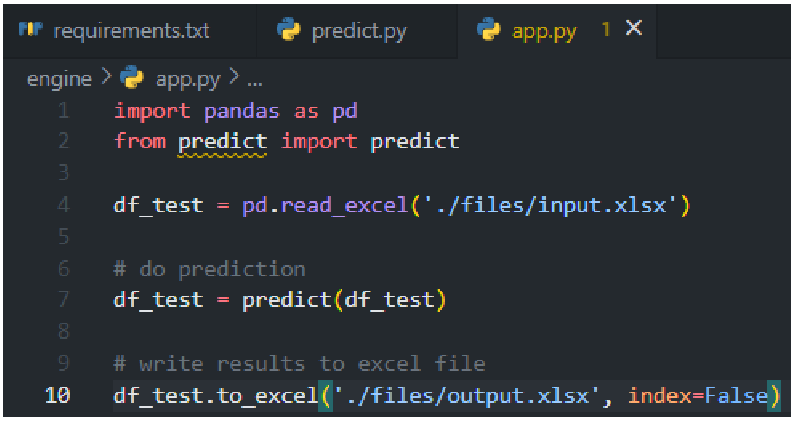
In-depth Descriptions

1. Input files: input.xlsx



input.xlsx – The input file for the dataset for the engine to predict results.
Output.xlsx – The output file from the engine, which includes the predicted results.
The engine reads the input.xlsx file by feeding the data into app.py:

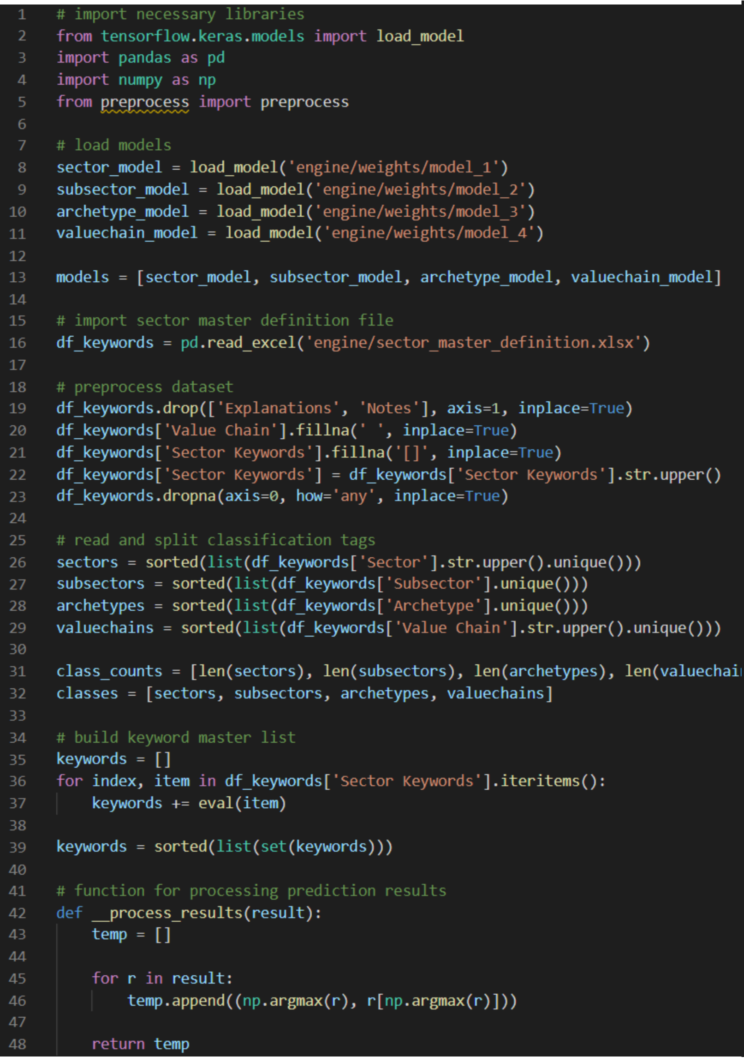
2. app.py



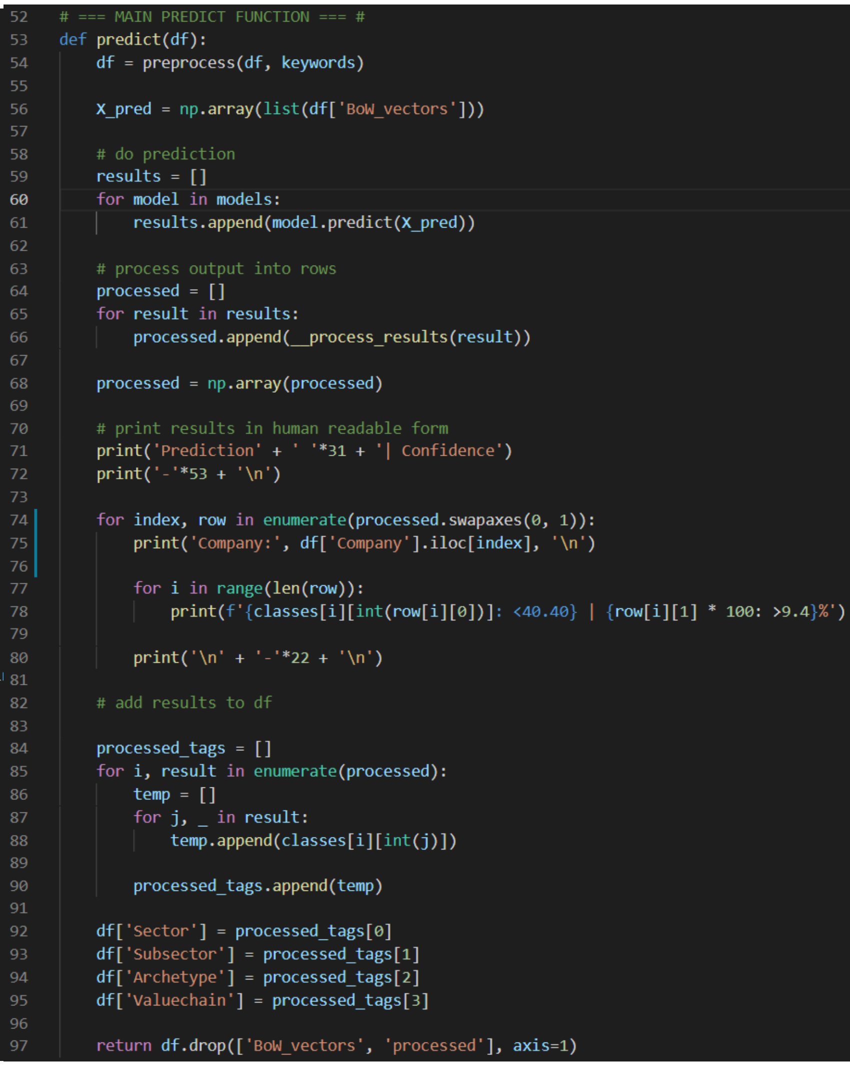
```python
import pandas as pd
from predict import predict

df_test = pd.read_excel('./files/input.xlsx')

# do prediction
df_test = predict(df_test)

# write results to excel file
df_test.to_excel('./files/output.xlsx', index=False)
```

Here, we read the dataset from the excel file and then populate it into a pandas dataframe. We then feed the data to the predict function found in predict.py. Finally when the prediction is done, we write the result to an output excel file.

1. predict.py



```python
# import necessary libraries
from tensorflow.keras.models import load_model
import pandas as pd
import numpy as np
from preprocess import preprocess

# load models
sector_model = load_model('engine/weights/model_1')
subsector_model = load_model('engine/weights/model_2')
archetype_model = load_model('engine/weights/model_3')
valuechain_model = load_model('engine/weights/model_4')

models = [sector_model, subsector_model, archetype_model, valuechain_model]

# import sector master definition file
df_keywords = pd.read_excel('engine/sector_master_definition.xlsx')

# preprocess dataset
df_keywords.drop(['Explanations', 'Notes'], axis=1, inplace=True)
df_keywords['Value Chain'].fillna(' ', inplace=True)
df_keywords['Sector Keywords'].fillna('[]', inplace=True)
df_keywords['Sector Keywords'] = df_keywords['Sector Keywords'].str.upper()
df_keywords.dropna(axis=0, how='any', inplace=True)

# read and split classification tags
sectors = sorted(list(df_keywords['Sector'].str.upper().unique()))
subsectors = sorted(list(df_keywords['Subsector'].unique()))
archetypes = sorted(list(df_keywords['Archetype'].unique()))
valuechains = sorted(list(df_keywords['Value Chain'].str.upper().unique()))

class_counts = [len(sectors), len(subsectors), len(archetypes), len(valuechai
classes = [sectors, subsectors, archetypes, valuechains]

# build keyword master list
keywords = []
for index, item in df_keywords['Sector Keywords'].iteritems():
    keywords += eval(item)

keywords = sorted(list(set(keywords)))

# function for processing prediction results
def __process_results(result):
    temp = []

    for r in result:
        temp.append((np.argmax(r), r[np.argmax(r)]))

    return temp
```



```python
# === MAIN PREDICT FUNCTION === #
def predict(df):
    df = preprocess(df, keywords)

    X_pred = np.array(list(df['BoW_vectors']))

    # do prediction
    results = []
    for model in models:
        results.append(model.predict(X_pred))

    # process output into rows
    processed = []
    for result in results:
        processed.append(__process_results(result))

    processed = np.array(processed)

    # print results in human readable form
    print('Prediction' + ' '*31 + '| Confidence')
    print('-'*53 + '\n')

    for index, row in enumerate(processed.swapaxes(0, 1)):
        print('Company:', df['Company'].iloc[index], '\n')

        for i in range(len(row)):
            print(f'{classes[i][int(row[i][0])]: <40.40} | {row[i][1] * 100: >9.4}%')

        print('\n' + '-'*22 + '\n')

    # add results to df

    processed_tags = []
    for i, result in enumerate(processed):
        temp = []
        for j, _ in result:
            temp.append(classes[i][int(j)])

        processed_tags.append(temp)

    df['Sector'] = processed_tags[0]
    df['Subsector'] = processed_tags[1]
    df['Archetype'] = processed_tags[2]
    df['Valuechain'] = processed_tags[3]

    return df.drop(['BoW_vectors', 'processed'], axis=1)
```

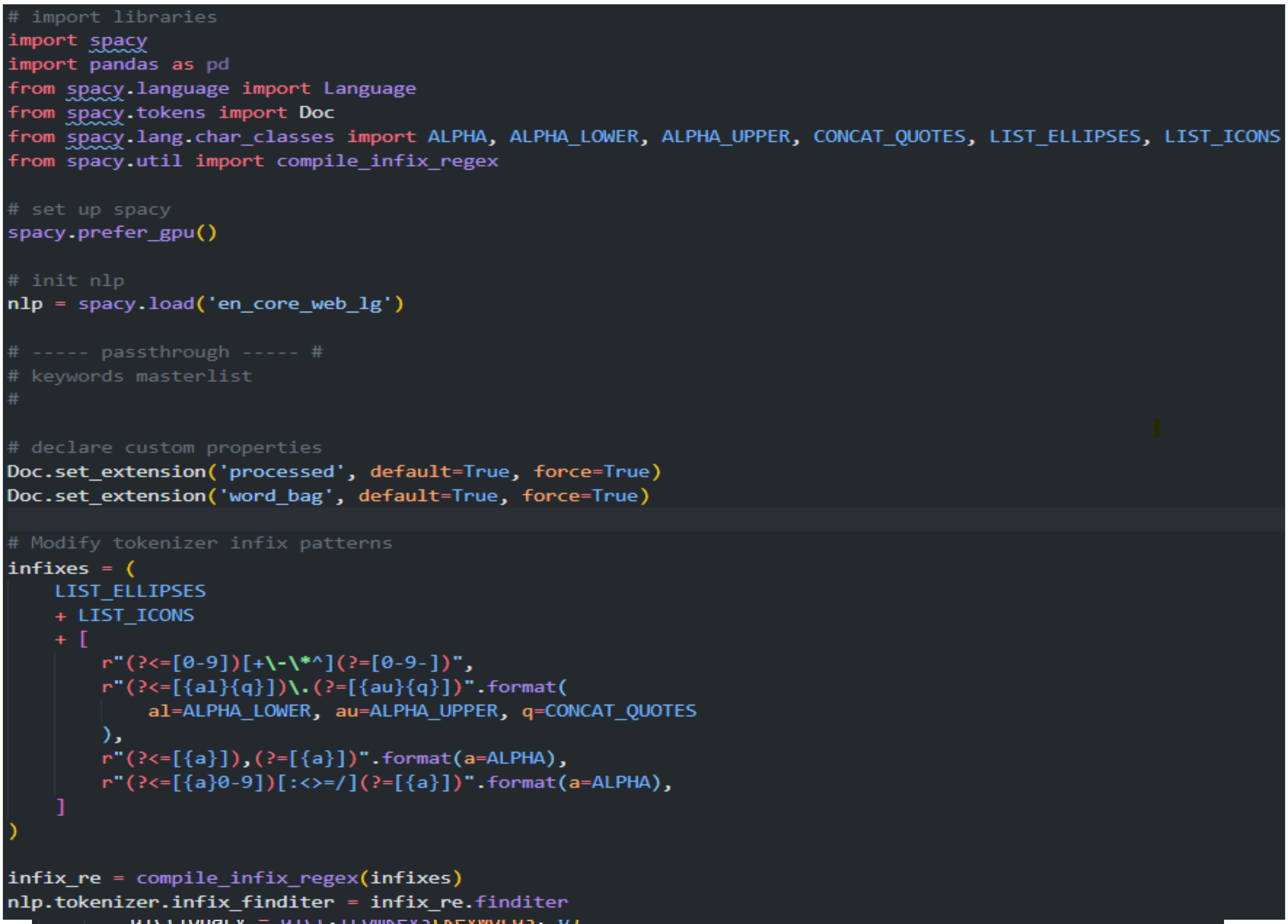
At predict.py, what we did first was to load the pre-trained model weights that were done in google collab and also gather the sector master definition file which was already found in the master directory of the repository, and then build our master list keywords.

__process_results(): A function to preprocess the predicted results, getting the argmax, or the highest percentage recorded score.

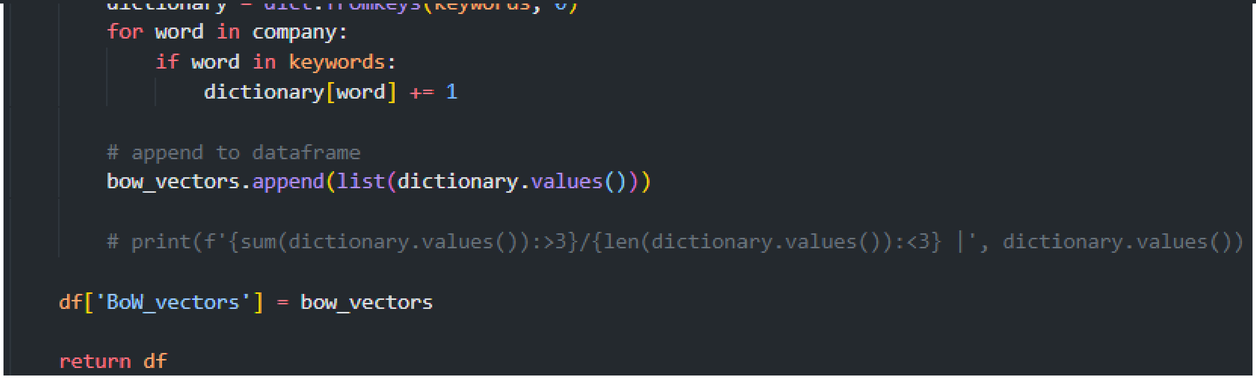
predict(): A function whereby we can preprocess our raw data first by calling another function called preprocess() coded in another file. We then use the returned result from that function to format the result and print out the confidence score based on each company.

predict(): A function whereby we can preprocess our raw data first by calling another function called preprocess() coded in another file. We then use the returned result from that function to format the result and print out the confidence score based on each company.

2. preprocess.py



```
# import libraries
import spacy
import pandas as pd
from spacy.language import Language
from spacy.tokens import Doc
from spacy.lang.char_classes import ALPHA, ALPHA_LOWER, ALPHA_UPPER, CONCAT_QUOTES, LIST_ELLIPSES, LIST_ICONS
from spacy.util import compile_infix_regex

# set up spacy
spacy.prefer_gpu()

# init nlp
nlp = spacy.load('en_core_web_lg')

# ----- passthrough ----- #
# keywords masterlist
#

# declare custom properties
Doc.set_extension('processed', default=True, force=True)
Doc.set_extension('word_bag', default=True, force=True)

# Modify tokenizer infix patterns
infixes = (
    LIST_ELLIPSES
    + LIST_ICONS
    + [
        r"(?<=[0-9])[+\-\*^](?=[0-9-])",
        r"(?<=[{al}{q}])\.(?=[{au}{q}])".format(
            al=ALPHA_LOWER, au=ALPHA_UPPER, q=CONCAT_QUOTES
        ),
        r"(?<=[{a}]),(?=[{a}])".format(a=ALPHA),
        r"(?<=[{a}0-9])[:<>=/](?=[{a}])".format(a=ALPHA),
    ]
)

infix_re = compile_infix_regex(infixes)
nlp.tokenizer.infix_finditer = infix_re.finditer
```

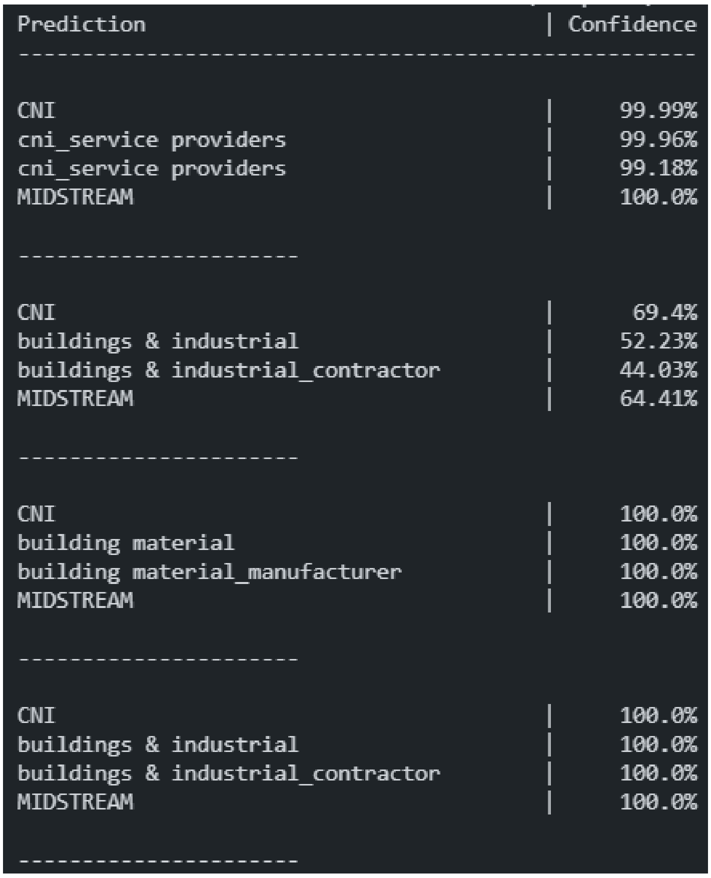


```
        dictionary = dict.fromkeys(keywords, 0)
        for word in company:
            if word in keywords:
                dictionary[word] += 1

        # append to dataframe
        bow_vectors.append(list(dictionary.values()))

        # print(f'{sum(dictionary.values()):>3}/{len(dictionary.values()):<3} |', dictionary.values())

    df['BoW_vectors'] = bow_vectors

    return df
```

At preprocess.py, where the data will be fed in from the predict.py after getting called, we will feed the data into spacy to do preprocessing, which includes tokenization, lemmenization, word cleaning, removing stop words, and punctuations.

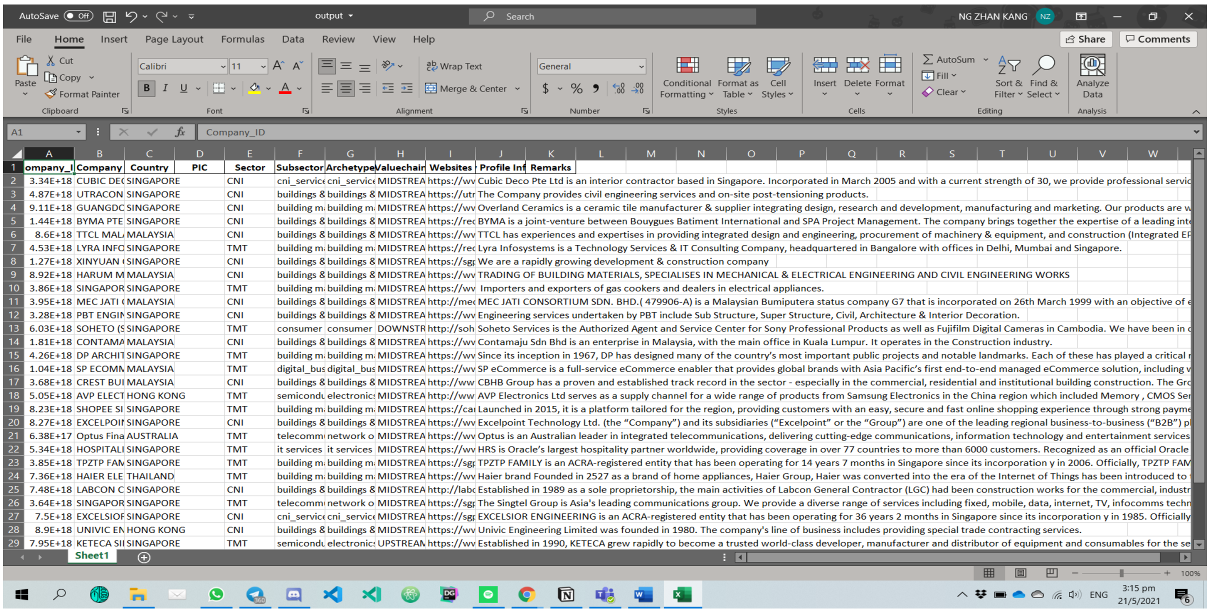
3. Results

Once the entire process has finished running, users can see the following results:



```
Prediction                                  | Confidence
---------------------------------------------------------

CNI                                         |     99.99%
cni_service providers                       |     99.96%
cni_service providers                       |     99.18%
MIDSTREAM                                   |     100.0%

----------------------

CNI                                         |      69.4%
buildings & industrial                      |     52.23%
buildings & industrial_contractor           |     44.03%
MIDSTREAM                                   |     64.41%

----------------------

CNI                                         |     100.0%
building material                           |     100.0%
building material_manufacturer              |     100.0%
MIDSTREAM                                   |     100.0%

----------------------

CNI                                         |     100.0%
buildings & industrial                      |     100.0%
buildings & industrial_contractor           |     100.0%
MIDSTREAM                                   |     100.0%

----------------------
```

And the output in the excel file:



	A	B	C	D	E	F	G	H	I	J	K
1	ompany_I	Company	Country	PIC	Sector	Subsector	Archetype	Valuechain	Websites	Profile Inf	Remarks
2	3.34E+18	CUBIC DE(	SINGAPORE		CNI	cni_service	cni_service	MIDSTREA	https://wv	Cubic Deco Pte Ltd is an interior contractor based in Singapore. Incorporated in March 2005 and with a current strength of 30, we provide professional servic	
3	4.87E+18	UTRACON	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://utr	The Company provides civil engineering services and on-site post-tensioning products.	
4	9.11E+18	GUANGDC	SINGAPORE		CNI	building m	building m	MIDSTREA	https://wv	Overland Ceramics is a ceramic tile manufacturer & supplier integrating design, research and development, manufacturing and marketing. Our products are w	
5	1.44E+18	BYMA PTE	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://rec	BYMA is a joint-venture between Bouygues Batiment International and SPA Project Management. The company brings together the expertise of a leading inte	
6	8.6E+18	TTCL MAL	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	https://wv	TTCL has experiences and expertises in providing integrated design and engineering, procurement of machinery & equipment, and construction (Integrated EP	
7	4.53E+18	LYRA INFO	SINGAPORE		TMT	building m	building m	MIDSTREA	https://rec	Lyra Infosystems is a Technology Services & IT Consulting Company, headquartered in Bangalore with offices in Delhi, Mumbai and Singapore.	
8	1.27E+18	XINYUAN (	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://sgp	We are a rapidly growing development & construction company	
9	8.92E+18	HARUM M	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	https://wv	TRADING OF BUILDING MATERIALS, SPECIALISES IN MECHANICAL & ELECTRICAL ENGINEERING AND CIVIL ENGINEERING WORKS	
10	3.86E+18	SINGAPOR	SINGAPORE		TMT	building m	building m	MIDSTREA	https://wv	Importers and exporters of gas cookers and dealers in electrical appliances.	
11	3.95E+18	MEC JATI (	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	http://mec	MEC JATI CONSORTIUM SDN. BHD.(479906-A) is a Malaysian Bumiputera status company G7 that is incorporated on 26th March 1999 with an objective of e	
12	3.28E+18	PBT ENGIN	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://wv	Engineering services undertaken by PBT include Sub Structure, Super Structure, Civil, Architecture & Interior Decoration.	
13	6.03E+18	SOHETO (S	SINGAPORE		TMT	consumer	consumer	DOWNSTR	http://soh	Soheto Services is the Authorized Agent and Service Center for Sony Professional Products as well as Fujifilm Digital Cameras in Cambodia. We have been in c	
14	1.81E+18	CONTAMA	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	https://wv	Contamaju Sdn Bhd is an enterprise in Malaysia, with the main office in Kuala Lumpur. It operates in the Construction industry.	
15	4.26E+18	DP ARCHIT	SINGAPORE		TMT	building m	building m	MIDSTREA	https://wv	Since its inception in 1967, DP has designed many of the country’s most important public projects and notable landmarks. Each of these has played a critical r	
16	1.04E+18	SP ECOMM	MALAYSIA		TMT	digital_bus	digital_bus	MIDSTREA	https://wv	SP eCommerce is a full-service eCommerce enabler that provides global brands with Asia Pacific’s first end-to-end managed eCommerce solution, including v	
17	3.68E+18	CREST BUI	MALAYSIA		CNI	buildings &	buildings &	MIDSTREA	http://ww	CBHB Group has a proven and established track record in the sector - especially in the commercial, residential and institutional building construction. The Gro	
18	5.05E+18	AVP ELECT	HONG KONG		TMT	semicondu	electronic:	MIDSTREA	http://ww	AVP Electronics Ltd serves as a supply channel for a wide range of products from Samsung Electronics in the China region which included Memory , CMOS Ser	
19	8.23E+18	SHOPEE SI	SINGAPORE		TMT	building m	building m	MIDSTREA	https://car	Launched in 2015, it is a platform tailored for the region, providing customers with an easy, secure and fast online shopping experience through strong payme	
20	8.27E+18	EXCELPOII	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	https://wv	Excelpoint Technology Ltd. (the “Company”) and its subsidiaries (“Excelpoint” or the “Group”) are one of the leading regional business-to-business (“B2B”) pl	
21	6.38E+17	Optus Fina	AUSTRALIA		TMT	telecomm	network o	MIDSTREA	https://wv	Optus is an Australian leader in integrated telecommunications, delivering cutting-edge communications, information technology and entertainment services	
22	5.34E+18	HOSPITALI	SINGAPORE		TMT	it services	it services	MIDSTREA	https://wv	HRS is Oracle’s largest hospitality partner worldwide, providing coverage in over 77 countries to more than 6000 customers. Recognized as an official Oracle	
23	3.85E+18	TPZTP FAM	SINGAPORE		TMT	building m	building m	MIDSTREA	https://sgp	TPZTP FAMILY is an ACRA-registered entity that has been operating for 14 years 7 months in Singapore since its incorporation y in 2006. Officially, TPZTP FAM	
24	7.36E+18	HAIER ELE	THAILAND		TMT	building m	building m	MIDSTREA	https://wv	Haier brand Founded in 2527 as a brand of home appliances, Haier Group, Haier was converted into the era of the Internet of Things has been introduced to t	
25	7.48E+18	LABCON C	SINGAPORE		CNI	buildings &	buildings &	MIDSTREA	http://labc	Established in 1989 as a sole proprietorship, the main activities of Labcon General Contractor (LGC) had been construction works for the commercial, industr	
26	3.64E+18	SINGAPOR	SINGAPORE		TMT	telecomm	network o	MIDSTREA	https://sgp	The Singtel Group is Asia's leading communications group. We provide a diverse range of services including fixed, mobile, data, internet, TV, infocomms techn	
27	7.5E+18	EXCELSIOF	SINGAPORE		CNI	cni_service	cni_service	MIDSTREA	https://sgp	EXCELSIOR ENGINEERING is an ACRA-registered entity that has been operating for 36 years 2 months in Singapore since its incorporation y in 1985. Officially	
28	8.9E+18	UNIVIC EN	HONG KONG		CNI	buildings &	buildings &	MIDSTREA	https://wv	Univic Engineering Limited was founded in 1980. The company's line of business includes providing special trade contracting services.	
29	7.95E+18	KETECA SII	SINGAPORE		TMT	semicondu	electronic:	UPSTREAM	https://wv	Established in 1990, KETECA grew rapidly to become a trusted world-class developer, manufacturer and distributor of equipment and consumables for the se	