

DNN-ISTA/ DNN-FISTA for Sparse Optimal Control : Environment Setup

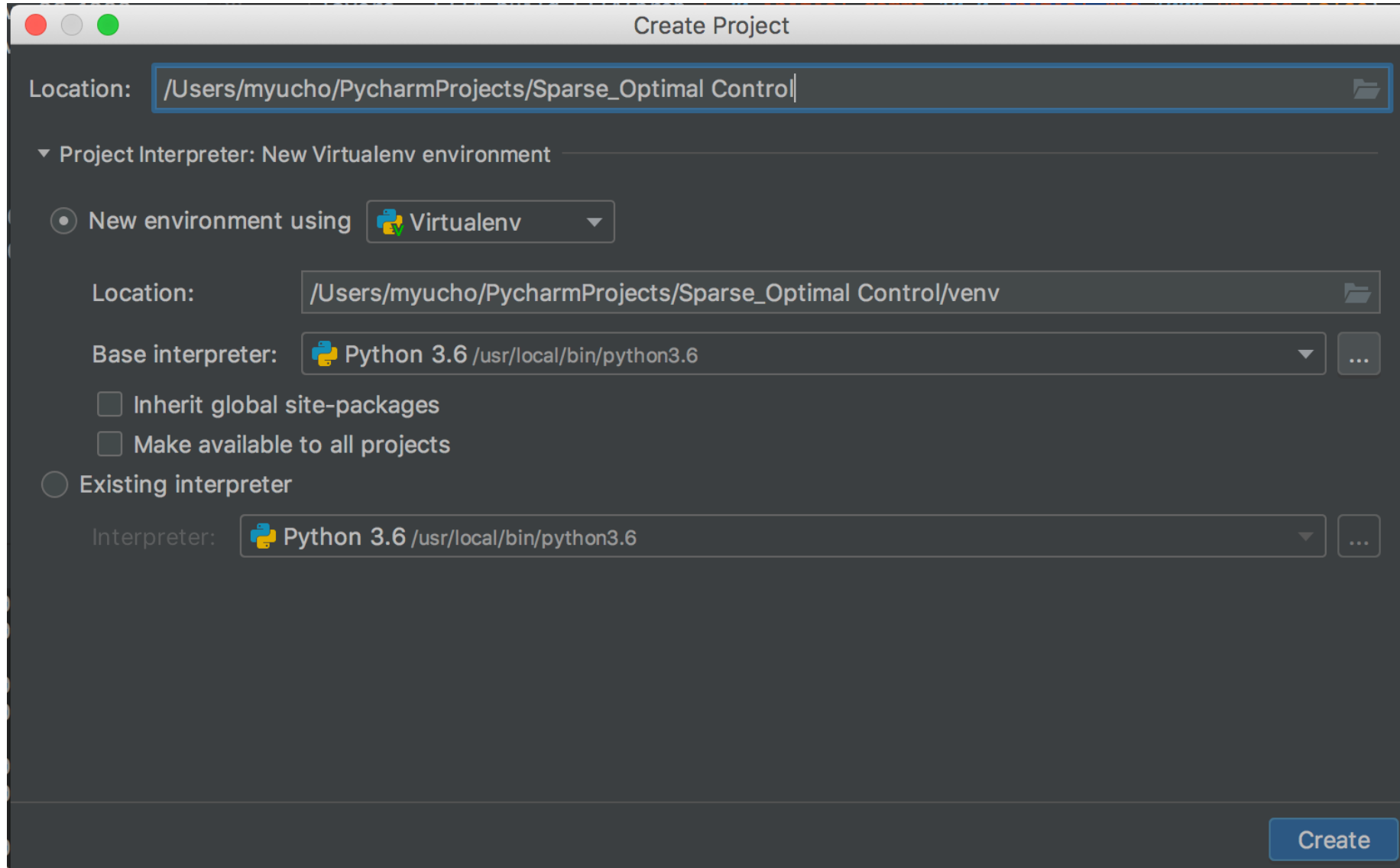
Fall, 2021

Myung (Michael) Cho

Software Versions

- Deep Neural networks based on Iterative Shrinkage-Threshold Algorithm (DNN-ISTA/DNN-FISTA) are implemented on iOS by using the following software and main python package:
 - Python 3.6 (Pycharm CE used)
 - Tensorflow 1.12.3

Step1: Create Project (with Virtual Environment)



The image shows the 'Create Project' dialog in PyCharm. The window title is 'Create Project'. It has a dark theme. The 'Location' field is set to '/Users/myucho/PycharmProjects/Sparse_Optimal Control'. Below this, the 'Project Interpreter' section is expanded, showing 'New Virtualenv environment' selected. Under this, 'New environment using' is selected with 'Virtualenv' as the backend. The 'Location' for the new environment is '/Users/myucho/PycharmProjects/Sparse_Optimal Control/venv'. The 'Base interpreter' is 'Python 3.6 /usr/local/bin/python3.6'. There are two checkboxes: 'Inherit global site-packages' and 'Make available to all projects', both of which are unchecked. Below this, 'Existing interpreter' is also an option, with the same 'Python 3.6 /usr/local/bin/python3.6' interpreter selected. A 'Create' button is at the bottom right.

Create Project

Location: /Users/myucho/PycharmProjects/Sparse_Optimal Control

▼ Project Interpreter: New Virtualenv environment

☒ New environment using Virtualenv

Location: /Users/myucho/PycharmProjects/Sparse_Optimal Control/venv

Base interpreter: Python 3.6 /usr/local/bin/python3.6

☐ Inherit global site-packages

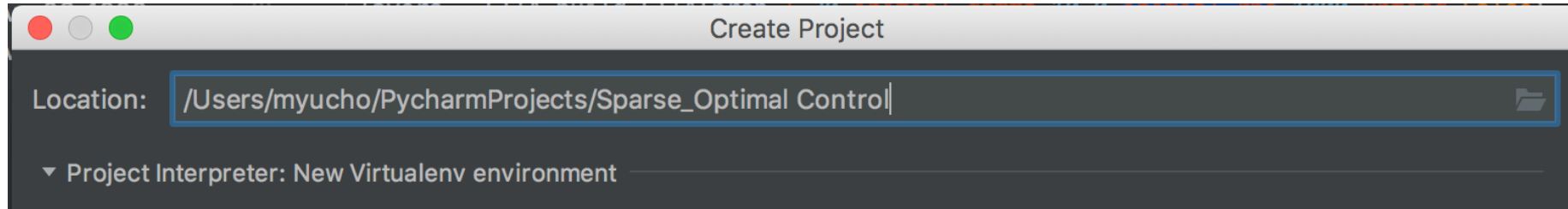
☐ Make available to all projects

☐ Existing interpreter

Interpreter: Python 3.6 /usr/local/bin/python3.6

Create

Step1: Create Project (with Virtual Environment)



```
(myucho)Michaels-MacBook-Pro: ~/PycharmProjects/sparse_optimal_control $ ls -lsa
total 24
0 drwxr-xr-x  5 myucho  staff   160 May 19 01:32 .
0 drwxr-xr-x@ 22 myucho  staff   704 May 19 01:27 ..
24 -rw-r--r--@  1 myucho  staff  8196 May 19 01:32 .DS_Store
0 drwxr-xr-x  5 myucho  staff   160 May 19 01:27 .idea
0 drwxr-xr-x  6 myucho  staff   192 May 19 01:27 venv
```

Virtual environment files are generated.

Step2: Activate Virtual Environment

```
(myucho)Michaels-MacBook-Pro: ~/PycharmProjects/sparse_optimal_control $ ls -lsa
total 24
0 drwxr-xr-x  5 myucho  staff   160 May 19 01:32 .
0 drwxr-xr-x@ 22 myucho  staff   704 May 19 01:27 ..
24 -rw-r--r--@  1 myucho  staff  8196 May 19 01:32 .DS_Store
0 drwxr-xr-x  5 myucho  staff   160 May 19 01:27 .idea
0 drwxr-xr-x  6 myucho  staff   192 May 19 01:27 venv
```

Go to venv/bin



```
(myucho)Michaels-MacBook-Pro: ~/PycharmProjects/sparse_optimal_control/venv/bin $ ls
activate      easy_install      pip3              python3
activate.csh  easy_install-3.6  pip3.6           python3.6
activate.fish pip               python
(myucho)Michaels-MacBook-Pro: ~/PycharmProjects/sparse_optimal_control/venv/bin $ source activate
(venv) (myucho)Michaels-MacBook-Pro: ~/PycharmProjects/sparse_optimal_control/venv/bin $
```

Activate the virtual environment by running “source activate”

Step3: Install necessary packages

Under the virtual environment, install tensorflow (version: 1.12.3)

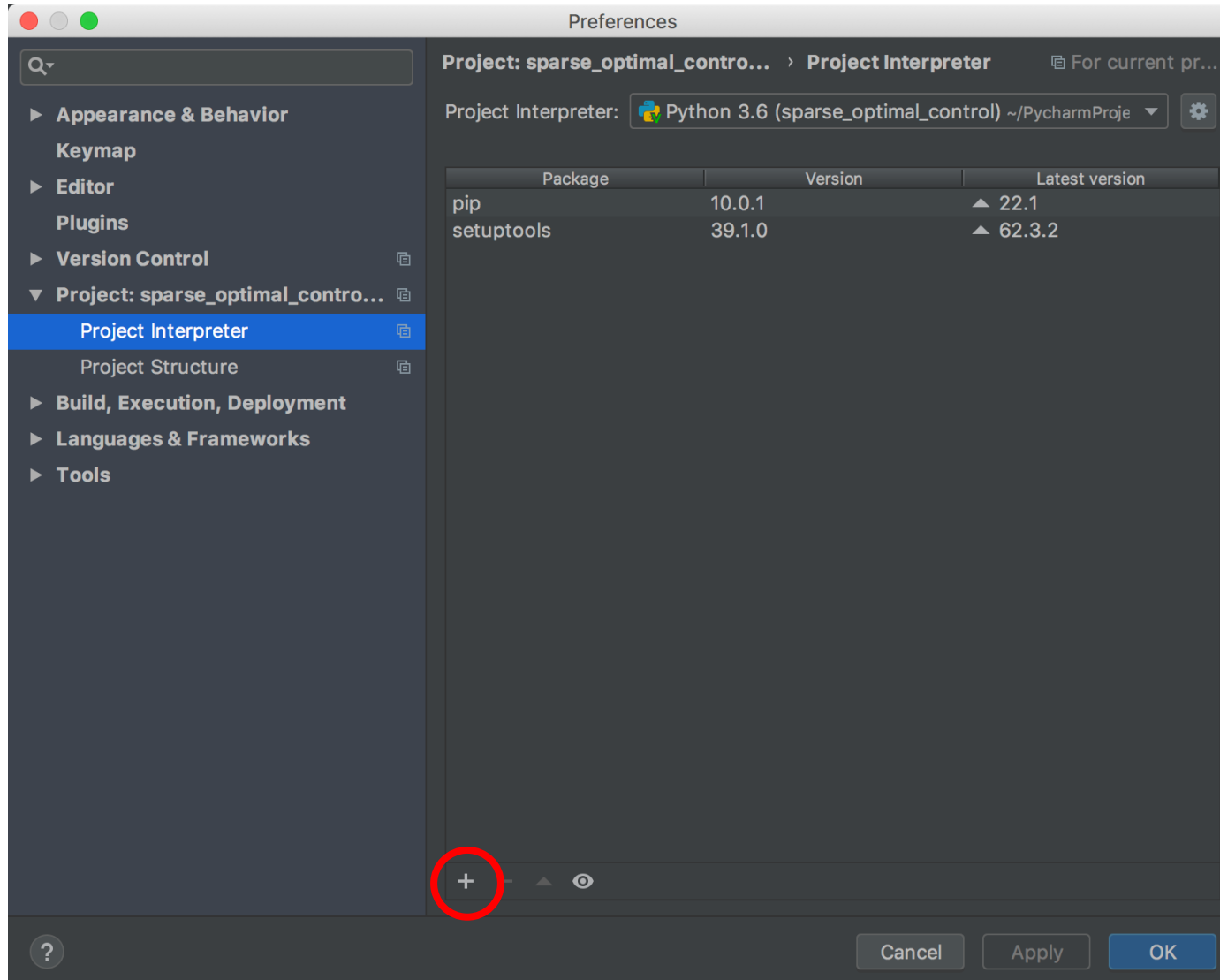
```
(venv) (myucho)Michaels-MacBook-Pro: ~/PycharmProjects/sparse_optimal_control/venv/bin $ python3.6 -m pip install tensorflow==1.12.3
```



```
Collecting dataclasses; python_version < "3.7" (from werkzeug>=0.11.10->tensorboard<1.13.0,>=1.12.0->tensorflow==1.12.3)
  Using cached https://files.pythonhosted.org/packages/fe/ca/75fac5856ab5cfa51bbbcefa250182e50441074fdc3f803f6e76451fab43/dataclasses-0.8-py3-none-any.whl
Collecting importlib-metadata>=4.4; python_version < "3.10" (from markdown>=2.6.8->tensorboard<1.13.0,>=1.12.0->tensorflow==1.12.3)
  Using cached https://files.pythonhosted.org/packages/a0/a1/b153a0a4caf7a7e3f15c2cd56c7702e2cf3d89b1b359d1f1c5e59d68f4ce/importlib_metadata-4.8.3-py3-none-any.whl
Collecting cached-property; python_version < "3.8" (from h5py->keras-applications>=1.0.6->tensorflow==1.12.3)
  Using cached https://files.pythonhosted.org/packages/48/19/f2090f7dad41e225c7f2326e4cfe6fff49e57dedb5b53636c9551f86b069/cached_property-1.5.2-py2.py3-none-any.whl
Collecting typing-extensions>=3.6.4; python_version < "3.8" (from importlib-metadata>=4.4; python_version < "3.10"->markdown>=2.6.8->tensorboard<1.13.0,>=1.12.0->tensorflow==1.12.3)
  Using cached https://files.pythonhosted.org/packages/45/6b/44f7f8f1e110027cf88956b59f2fad776cca7e1704396d043f89effd3a0e/typing_extensions-4.1.1-py3-none-any.whl
Collecting zipp>=0.5 (from importlib-metadata>=4.4; python_version < "3.10"->markdown>=2.6.8->tensorboard<1.13.0,>=1.12.0->tensorflow==1.12.3)
  Using cached https://files.pythonhosted.org/packages/bd/df/d4a4974a3e3957fd1c1fa3082366d7fff6e428ddb55f074bf64876f8e8ad/zipp-3.6.0-py3-none-any.whl
Installing collected packages: six, wheel, protobuf, dataclasses, werkzeug, numpy, grpcio, typing-extensions, zipp, importlib-metadata, markdown, tensorboard, astor, keras-preprocessing, termcolor, cached-property, h5py, keras-applications, gast, absl-py, tensorflow
Running setup.py install for termcolor ... done
Successfully installed absl-py-1.0.0 astor-0.8.1 cached-property-1.5.2 dataclasses-0.8 gast-0.5.3 grpcio-1.46.1 h5py-3.1.0 importlib-metadata-4.8.3 keras-applications-1.0.8 keras-preprocessing-1.1.2 markdown-3.3.7 numpy-1.19.5 protobuf-3.19.4 six-1.16.0 tensorboard-1.12.2 tensorflow-1.12.3 termcolor-1.1.0 typing-extensions-4.1.1 werkzeug-2.0.3 wheel-0.37.1 zipp-3.6.0
```

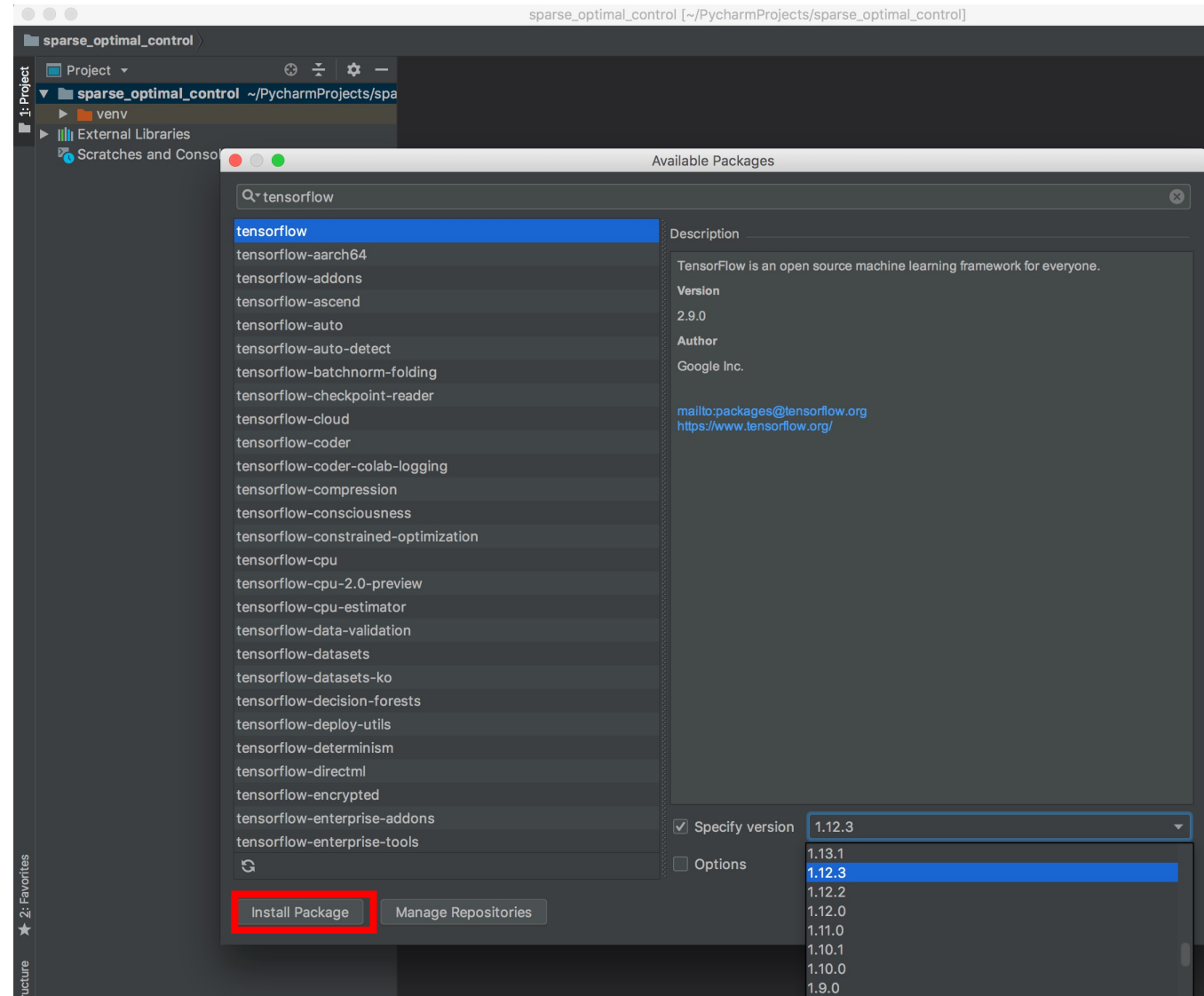
(Appendix) Step3: Install necessary packages

Or you can go to PyCharm/Preferences/Project Interpreter



(Appendix) Step3: Install necessary packages

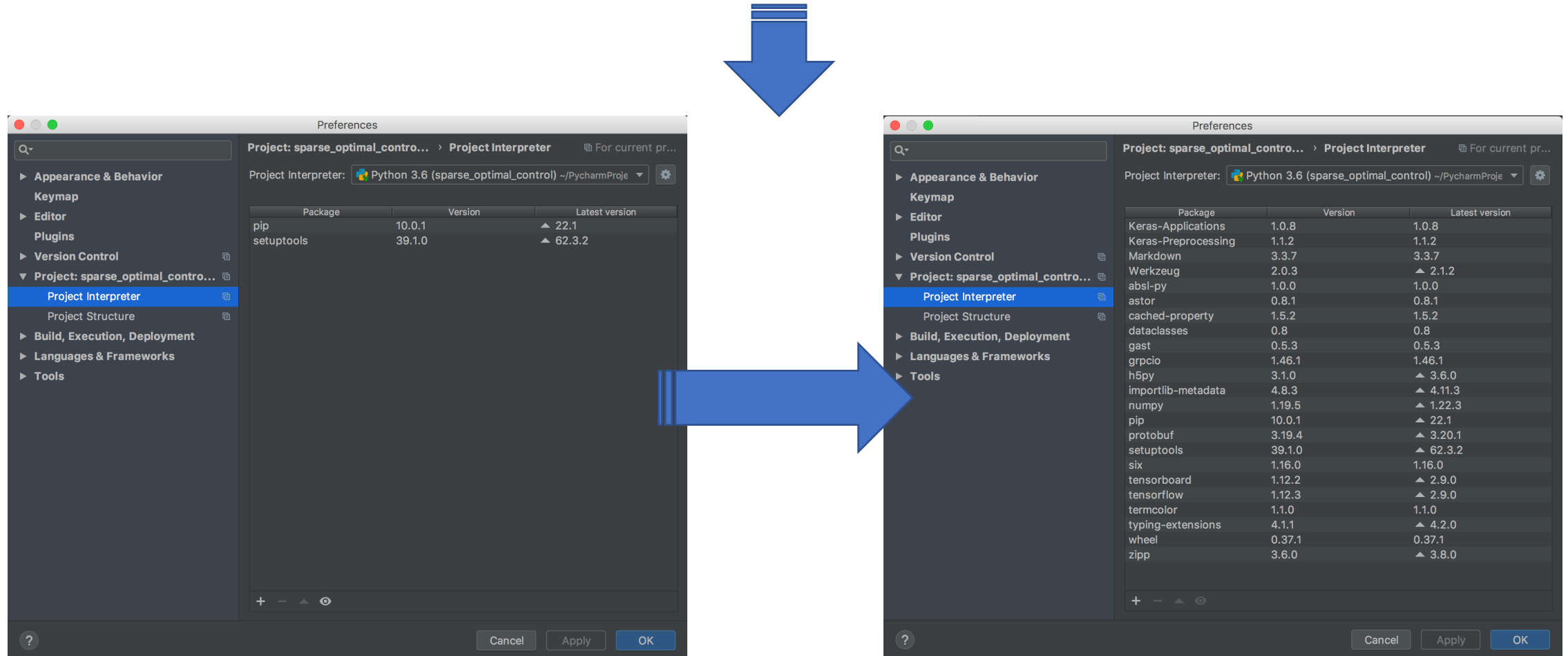
Or you can go to PyCharm/Preferences/Project Interpreter



Step3: Install necessary packages

Under the virtual environment, install tensorflow (version: 1.12.3)

```
(venv) (myucho)Michaels-MacBook-Pro: ~/PycharmProjects/sparse_optimal_control/venv/bin $ python3.6 -m pip install tensorflow==1.12.3
```



If the package is successfully installed, you will be able to see the packages in the PyCharm project (e.g., sparse_optimal_control).

Step3: Install necessary packages

Under the virtual environment, also install scipy

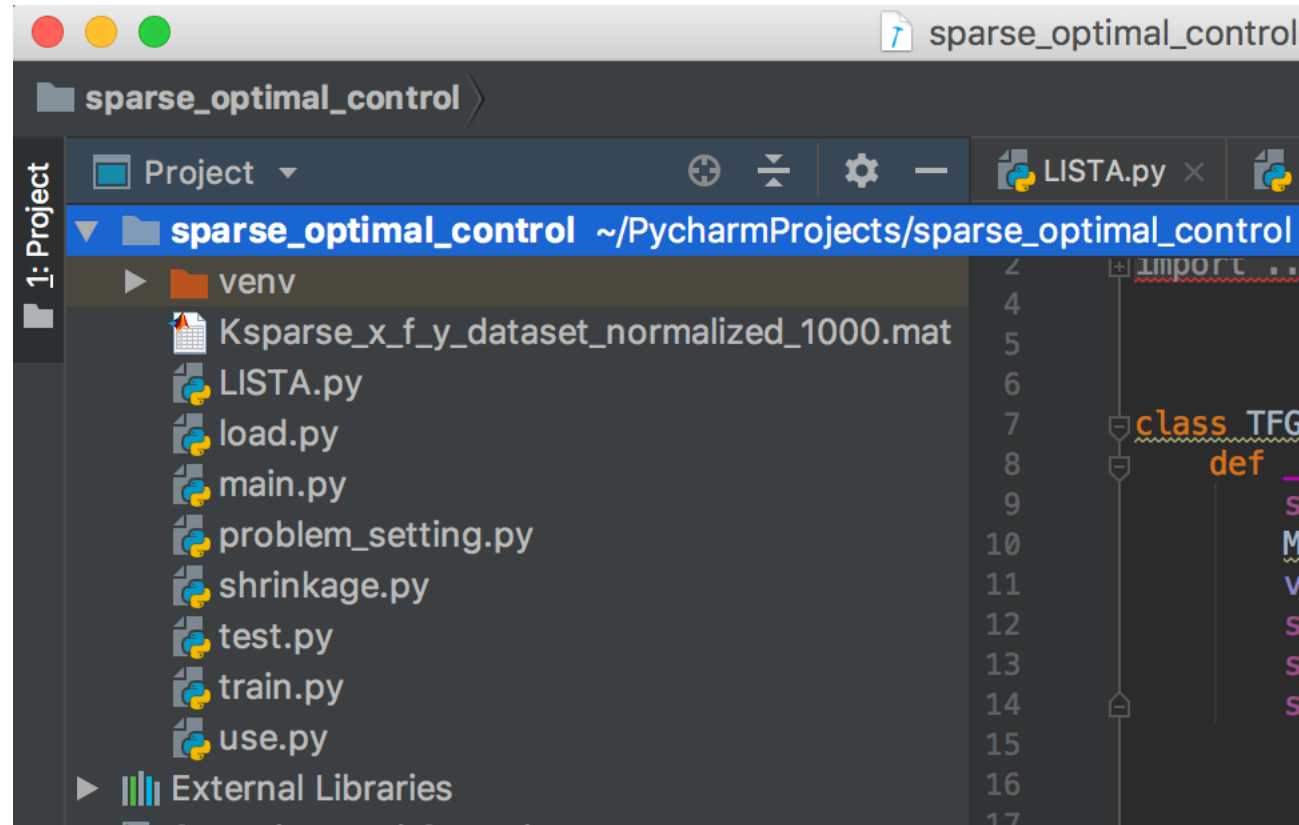
```
(venv) (myucho)Michaels-MacBook-Pro: ~/PycharmProjects/sparse_optimal_control/venv/bin $ python3.6 -m pip install scipy
```



```
(venv) (myucho)Michaels-MacBook-Pro: ~/PycharmProjects/sparse_optimal_control/venv/bin $ python3.6 -m pip install scipy
Collecting scipy
  Downloading https://files.pythonhosted.org/packages/47/c7/348acee81b0cf8eec66b4a71c8cca188f405061cb76cc3f9f72249568a22/scipy-1.5.4-cp36-cp36m-macosx_10_9_x86_64.whl (28.8MB)
    100% |#####| 28.8MB 801kB/s
Requirement already satisfied: numpy>=1.14.5 in /Users/myucho/PycharmProjects/sparse_optimal_control/venv/lib/python3.6/site-packages (from scipy) (1.19.5)
Installing collected packages: scipy
Successfully installed scipy-1.5.4
```

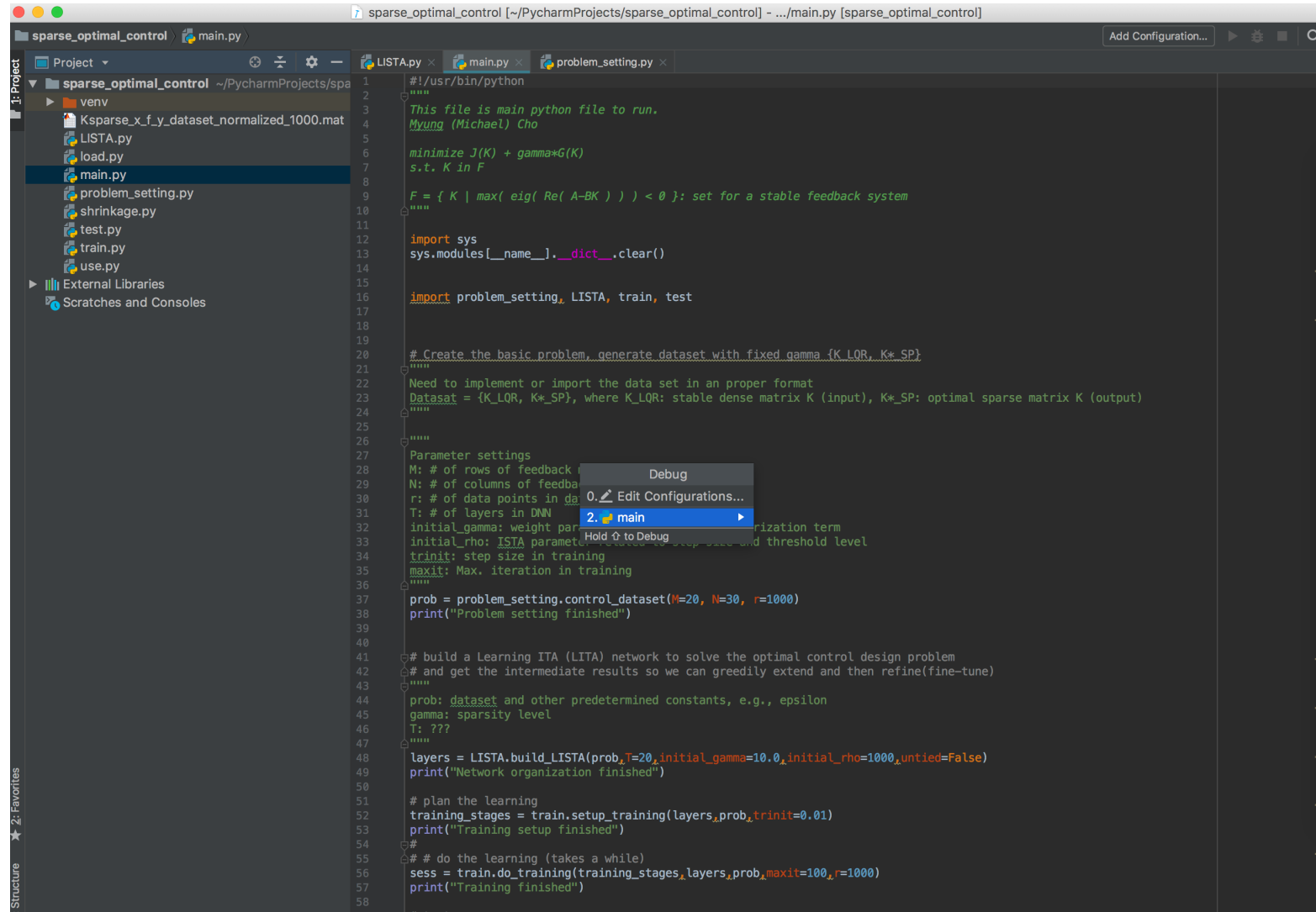
Step4: Copy files

Copy DNN-ISTA (or DNN-FISTA) files and dataset to the project folder



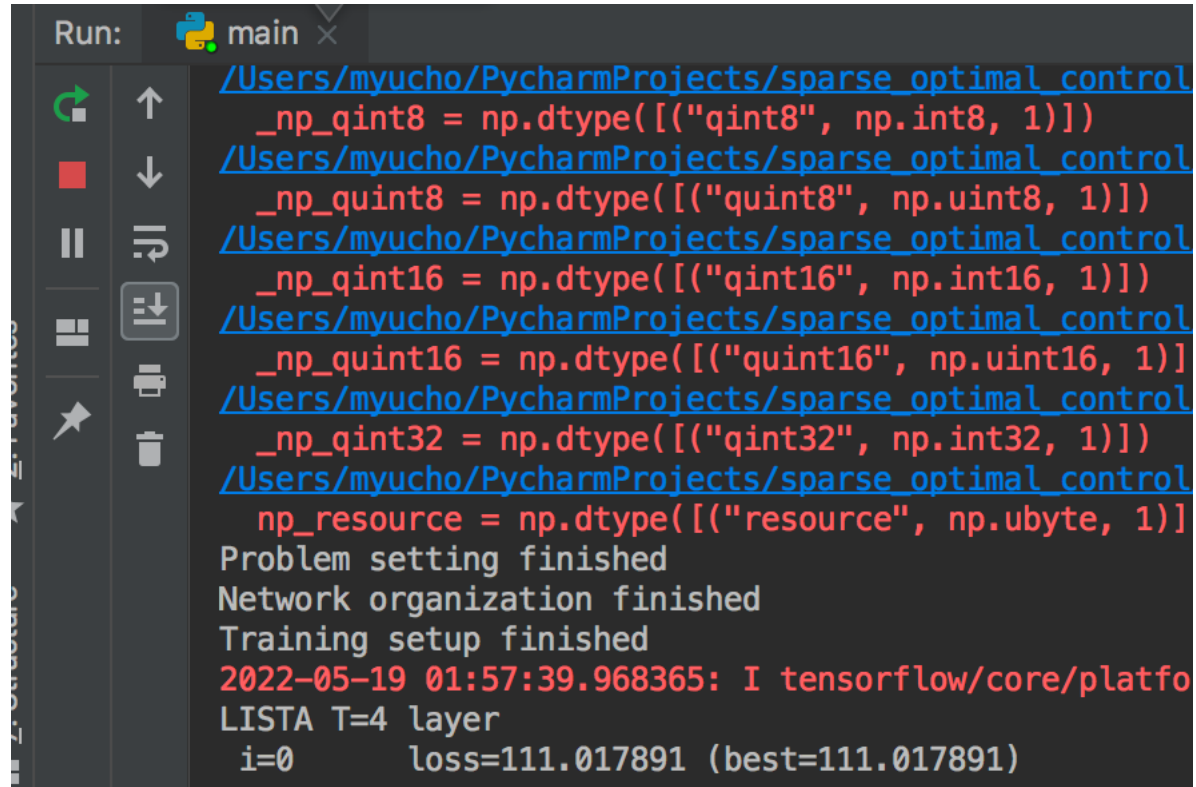
Step5: Run main.py

Go to PyCharm/Run/Run 'main.py'



Step5: Run main.py

Go to PyCharm/Run/Run 'main.py'

A screenshot of the PyCharm Run console window. The title bar shows 'Run: main'. The console output displays the file path for 'sparse_optimal_control' and the initialization of various NumPy data types. It also shows status messages for problem setting, network organization, and training setup, followed by a TensorFlow log message and the start of a layer training process.

```
Run: main
/Users/myucho/PycharmProjects/sparse_optimal_control
_np_qint8 = np.dtype(['qint8', np.int8, 1])
/Users/myucho/PycharmProjects/sparse_optimal_control
_np_quint8 = np.dtype(['quint8', np.uint8, 1])
/Users/myucho/PycharmProjects/sparse_optimal_control
_np_qint16 = np.dtype(['qint16', np.int16, 1])
/Users/myucho/PycharmProjects/sparse_optimal_control
_np_quint16 = np.dtype(['quint16', np.uint16, 1])
/Users/myucho/PycharmProjects/sparse_optimal_control
_np_qint32 = np.dtype(['qint32', np.int32, 1])
/Users/myucho/PycharmProjects/sparse_optimal_control
_np_resource = np.dtype(['resource', np.ubyte, 1])
Problem setting finished
Network organization finished
Training setup finished
2022-05-19 01:57:39.968365: I tensorflow/core/platfo
LISTA T=4 layer
i=0      loss=111.017891 (best=111.017891)
```

Dataset

- Dataset is generated in Matlab program and stored in a mat file format.
- “00_Dataset” folder has data_generate source file
“Ksparse_data_gen.m” to generate a dataset for DNN-ISTA/FISTA.