Installation Guide
5SSD0 Bayesian Machine Learning & Information Processing

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This guide will help you install everything you need to run the course notebooks on your own machine (Windows, Ubuntu or MacOS). We assume basic familiarity with the use of shells and prompts on your computer, for instance changing directories with `cd`. If you can't get things to work, check the notes at the end of this document. If that doesn't solve it, ask us in the course forum or raise an issue on Github (`https://github.com/bertdv/bmlip/issues`).

1   Windows

Windows is the most challenging platform. If things don't work out, consider installing Ubuntu as a subsystem and work from there (available from the Windows store as 'Ubuntu', more information here: `https://ubuntu.com/tutorials/tutorial-ubuntu-on-windows`).

1.1   Julia

Go to `https://julialang.org/downloads/` and download the Windows executable for the **stable release v1.5.2**. Or enter the following URL in your browser:

```
https://julialang-s3.julialang.org/bin/winnt/x64/1.5/julia-1.5.2-win64.exe
```

Finish the installation process with default settings. You can check whether this step succeeded by calling a Julia shell from your list of programs (see Fig. 1).
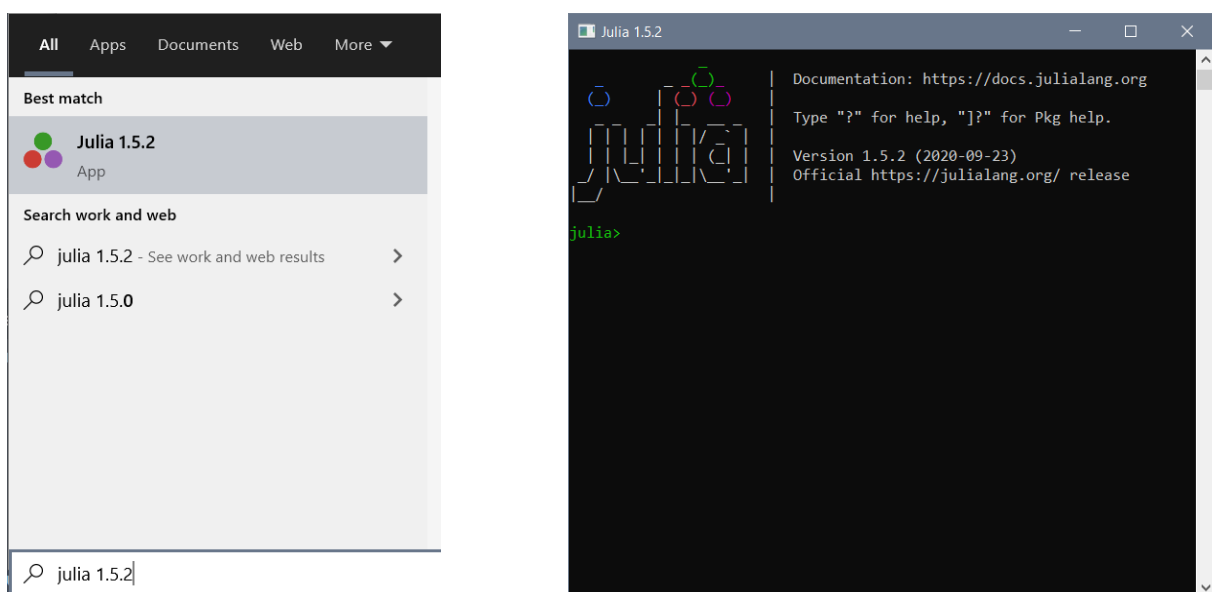

Figure 1: Julia shell on Windows.

1.2 Jupyter

To install Jupyter, we need a Python environment. If you already have a Python environment, you can skip the next step.

1.2.1 You do not have Python installed

The easiest way to set this up is by installing a Miniconda environment. Go to `https://docs.conda.io/en/latest/miniconda.html#windows-installers` and download the Windows executable for **Python 3.8** (the link called `Miniconda3 Windows 64-bit`). Or enter the following in your browser:

```
1    https://repo.anaconda.com/miniconda/Miniconda3-latest-Windows-x86_64.exe
```

Run the installer with default settings. Now, we can install Jupyter via Conda. Open a Miniconda shell (see Fig. 2) and run the following command:

```
1    conda install -c anaconda jupyter
```

While you're at it, install Matplotlib as well. You'll need it for some plotting functions. Run:

```
1    conda install -c conda-forge matplotlib
```

To check if the installation was successful, run `conda list` and look for 'jupyter' and 'matplotlib'.

1.2.2 You have Python installed

If you have Python installed (note that you need Python **3**), but not Conda, then you can install Jupyter and Matplotlib via:

```
1    pip install jupyter matplotlib
```

If you're having problems with installing via Pip, download Miniconda. It can be removed without affecting your existing Python environment.

1.3 IJulia

IJulia is a Julia package that lets you add a Julia kernel to your Jupyter setup easily. Open Start, type `julia 1.5.2` and run the shell. Enter the following lines of code sequentially:

```
1    using Pkg
2    Pkg.add("IJulia")
3    using IJulia
4    installkernel("julia")
```
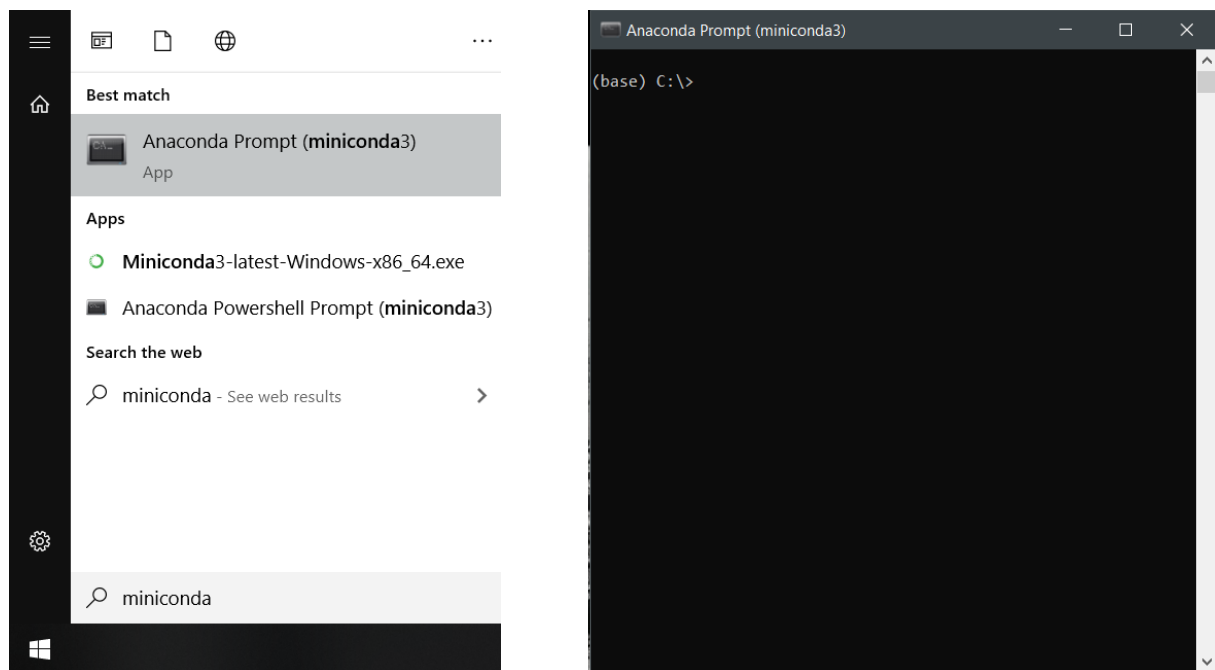
Figure 2: Anaconda prompt on Windows.

If you now start a Jupyter notebook, you should have the option to use a Julia kernel. Specifically, it should be **version 1.5.2**, indicated by JULIA-1.5.2.

1.4 GraphViz

GraphViz can be a bit troublesome to install on Windows. Download the executable via the following link `https://www2.graphviz.org/Packages/stable/windows/10/cmake/ Release/x64/graphviz-install-2.44.1-win64.exe`. Run everything with default settings. Once complete, open a Miniconda shell and run: `dot -V`. If that gives you a version number, then you're good to go. If it gives you an error stating that it does not know the command `dot`, then something went wrong with adding the binary to PATH. To fix that, type `environment variables` into Start and open the Environment Variables window (see Fig. 3). The top part shows settings for the current user. One of the variables is called "Path", double-click that one. That will give you a list of folders. Click "New" and add the folder where you installed graphviz:

```
1    C:/<path/to/graphviz>/Graphviz2.44/bin
```

Try running `dot -V` again. If you're still getting the unknown command error, ask for help in the course forum.
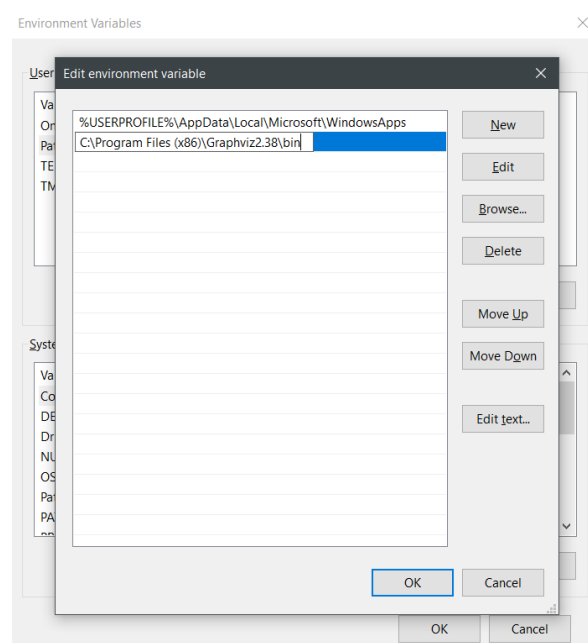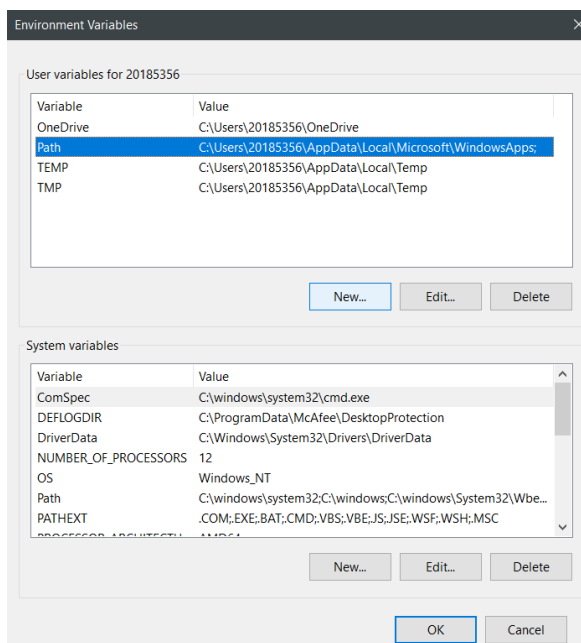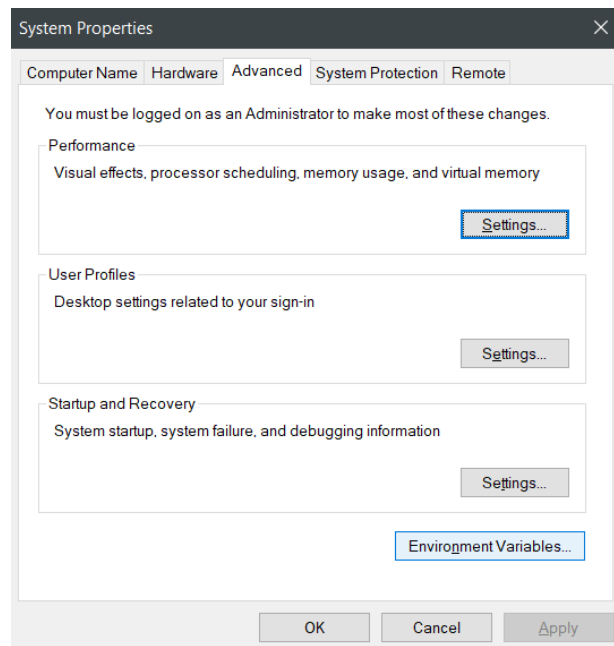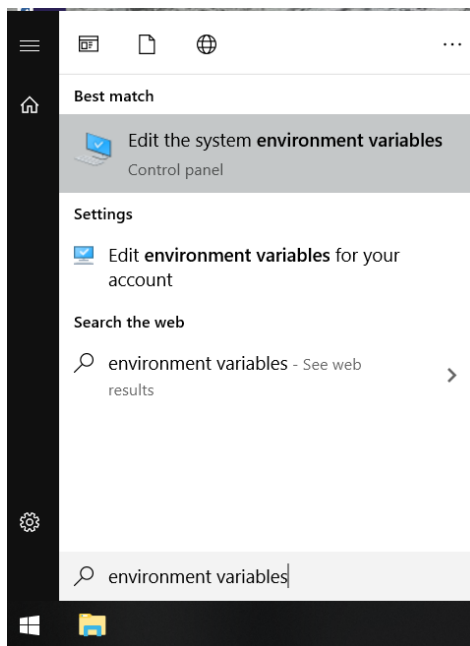
Figure 3: Adding Graphviz to your PATH variable. 1) Type 'environment variables' in Start and click the link to the Control Panel. 2) Click the 'Environment Variables' button. 3) Double-click 'Path' in the list of user variables. 4) Add '<path>\Graphviz2.44\bin' as a 'New' entry.

2 Ubuntu

Ubuntu is the easiest platform, since most of the software was designed on Linux machines.

2.1 Julia

We are going to follow this help page: `https://julialang.org/downloads/platform/#linux-and-freebsd`. Start by downloading the Julia **stable release v1.5.2** tarball ('Generic Linux Binaries for x86') from `https://julialang.org/downloads/`. Put it in 'Downloads', extract the tarball and move the extracted directory to '/opt/'. To do that, use the following command-line arguments:

```
1   cd ~/Downloads/
2   wget https://julialang-s3.julialang.org/bin/linux/x64/1.5/julia-1.5.2-linux-x86_64.tar.gz
3   tar zxvf julia-1.5.2-linux-x86_64.tar.gz
4   sudo mv julia-1.5.2 /opt/
```

The created directory `/opt/julia-1.5.2/` is your "Julia installation directory". To finish installation, create a symbolic link from the Julia installation directory to your binaries directory. Run:

```
1   sudo ln -s /opt/julia-1.5.2/bin/julia /usr/local/bin/julia
```

You should now be able to open a terminal and call `julia`.

2.2 Jupyter

To install Jupyter, we need a Python environment. If you already have Python or Conda installed, you can skip the next step.

2.2.1 You do not have Python installed

The easiest way to set up a proper Python environment is by installing Miniconda. Go to `https://docs.conda.io/en/latest/miniconda.html#linux-installers` and download the package for **Python 3.8** (the link for `Miniconda3 Linux 64-bit`). Run the installer by opening a terminal, navigating to the download directory and calling:

```
1   bash Miniconda3-latest-Linux-x86_64.sh
```

Accept all default settings, unless you're familiar with the questions asked. Now that we have a Miniconda environment, we will install Jupyter as well as Matplotlib via Conda. Open a terminal and run the following two commands:

```
1   conda install -c anaconda jupyter
2   conda install -c conda-forge matplotlib
```

Check for successful install by running `conda list` and checking whether packages are listed.

2.2.2 You have Python installed

If you have Python installed, but not Conda, then you can install Jupyter and Matplotlib via:

```
1    pip install jupyter matplotlib
```

If you're having problems with installing via Pip, download Miniconda. It can be removed without affecting your existing Python environment.

2.3 IJulia

This one's easy. Open a terminal, run `julia` and:

```
1    using Pkg
2    Pkg.add("IJulia")
3    using IJulia
4    installkernel("julia")
```

You should now be able to run a Julia kernel in your Jupyter notebook. Specifically, it should be version **1.5.2**, indicated by JULIA-1.5.2.

2.4 GraphViz

This is a one-liner:

```
1    sudo apt-get install graphviz
```

Check whether it installed correctly by running `dot -V`.

3 MacOS

MacOS's procedure follows Ubuntu's procedure.

3.1 Julia

Install Julia via the `.dmg` package found at:

```
1    https://julialang-s3.julialang.org/bin/mac/x64/1.5/julia-1.5.2-mac64.dmg
```

Visit `https://julialang.org/downloads/platform/#macos` for tips. You should be able to open a terminal and enter `julia`.

3.2 Jupyter

To install Jupyter, we need a Python environment. If you already have Python or Conda installed, you can skip the next step.

3.2.1 You do not have Python installed

The easiest way to set up a proper Python environment is by installing Miniconda. Go to `https://docs.conda.io/en/latest/miniconda.html#macosx-installers` and download the package for **Python 3.8** (the link called `Miniconda3 MacOSX 64-bit bash`). Run the installer by opening a terminal, navigating to the download directory and calling:

```
1    bash Miniconda3-latest-MacOSX-x86_64.sh
```

Accept all default settings, unless you're familiar with the questions asked. Now that we have a Miniconda environment, we will install Jupyter as well as Matplotlib via Conda. Open a terminal and run the following two commands:

```
1    conda install -c anaconda jupyter
2    conda install -c conda-forge matplotlib
```

Check for successful install by running `conda list` and seeing if jupyter and matplotlib are listed.

3.2.2 You have Python installed

If you have Python installed, but not Conda, then you can install Jupyter and Matplotlib via:

```
1    pip install jupyter matplotlib
```

If you're having problems with installing via Pip, download Miniconda. It can be removed without affecting your existing Python environment.

3.3 IJulia

Open a terminal, run 'julia' and enter:

```
1    using Pkg
2    Pkg.add("IJulia")
3    using IJulia
4    installkernel("julia")
```

You should now be able to run a Julia kernel in your Jupyter notebook. Specifically, it should be version **1.5.2**, indicated by JULIA-1.5.2.

3.4 GraphViz

We are following the guide on Graphviz's website `https://www.graphviz.org/download/`. You need to have either HomeBrew or MacPorts installed as a package manager. On Home-Brew, the command is:

```
1    brew install graphviz
```

and via MacPorts, the command is:

```
1    sudo port install graphviz
```

In both cases, check whether it installed correctly by running `dot -V`.

Opening notebooks

If you've completed all of the installation steps above, then you should be able to open and run the course notebooks. To download the notebooks, go to our Github repository, `https://github.com/bertdv/BMLIP`, and push the green 'Clone or download' button. Unzip the package, open a terminal (on Windows, it doesn't matter whether you use an Anaconda prompt or the Command Prompt) and navigate to the course directory (i.e. '<path/where/you/unzipped/-package/BMLIP>'). Start Jupyter by running

```
1    jupyter notebook
```

in the terminal/prompt. The localhost link will be opened in your default browser automatically (it should look something like Fig. 4). For more info on Windows, check `https://tinyurl.com/ul6a9hy`. Click 'lessons' and then 'notebooks'. The notebooks (files ending in .ipynb) you see in front of you, are Bert's lectures. The Probabilistic Programming notebooks are under the directory 'probprog'.

Figure 4: Starting a Jupyter notebook in the course repository.

3.5   Testing for successful installation

The notebook called `Probabilistic-Programming-0.ipynb` is there for you to test your installation. To check whether you're all set to go, click 'Cell' and 'Run all'. If you don't get errors, then you're done.

Possible solutions

This is a list of things to try if you run into any unexpected problems.

- If you're getting weird errors during installation and you notice your internet connection being unstable, verify the integrity of your downloads. For Ubuntu and MacOS, this is done by opening a terminal and running

```
1    sha256sum <download>
```

You should check whether the number it spits out matches the number listed on the website of the download. On Windows, the command is:

```
1    CertUtil -hashfile C:\<path\to\download>.msi SHA256
```

via the Command Prompt.