A manual for installing FASTCORE, COBRA Toolbox V3, IBM CPLEX 12.10 & MATLAB R2019b for Windows 10

Windows version: 10.0.19042 Build 19042

Due to the multiple issues with CPLEX-MATLAB, guaranteed comptability versions are recommended (This manual will use the latest comptability **MATLAB** R2019b + **CPLEX** 12.10)

1- Installing MATLAB R2019b

1. Go to https://nl.mathworks.com/ and create an account using your student/academic email.
2. Sign-in to the same website using your account.
3. Open https://nl.mathworks.com/downloads/ then click on "Show more" on the left side.
4. Choose R2019b version then download MATLAB installer.
5. Check these MATLAB toolboxes during installing:

Bioinformatics Toolbox (required)
Curve Fitting Toolbox (required)
Optimization Toolbox
Parallel Computing Toolbox
Signal Processing Toolbox
SimBiology
Statistics and Machine Learning Toolbox
Symbolic Math Toolbox

2- Installing CPLEX Optimization Studio 12.10 :

2.1. Downloading CPLEX Optimization Studio 12.10 :

- Go to https://www.ibm.com/academic/topic/data-science
- Register an IBM account with an academic email.
- Go back to https://www.ibm.com/academic/topic/data-science, and sign in with your account.
- Scroll down then click on "Software" on the Left
- Click on the arrow below "ILOG CPLEX Optimization Studio"
- Click on "Download"
- Click on "Search for Software" on the left side.
- Search for "IBM ILOG CPLEX Optimization Studio 12.10.0 for Windows x86-64 Multilingual"
- Click on "HTTP", then click on the checkbox for the Windows version.
- Choose "I agree", then "Download Now"

2.2 Install CPLEX pre-requisites:

a. The latest Git for Windows:
https://git-scm.com/download/win
Caution is required in the installation process of ' Git'. The usual installation wizard is suggesting a bunch of settings where the recommended one is not the one required for Cobratoolbox. See https://opencobra.github.io/cobratoolbox/stable/installation.html#system-requirements images when scrolling a bit down.

b. Visual Studio for Windows:
https://visualstudio.microsoft.com/

c. Oracle Java SDK/JRE/JDK

For Windows pre-requisites, check: https://www.ibm.com/support/pages/detailed-system-requirements-ibm-ilog-cplex-optimization-studio#1210

- Made sure to uninstall other CPLEX versions installation, before beginning installing CPLEX 12.10

2.3. Install the CPLEX from the downloaded installer:

- Open MATLAB as administrator
- Check the parent folder manually (C:\Program Files\IBM\ILOG\CPLEX_Studio1210\cplex\bin\x64_win64), and if the @Cplex folder is missing, please uninstall, then reinstall CPLEX

- Then run these lines in MATLAB to add the CPLEX path.

- `addpath('C:\Program Files\IBM\ILOG\CPLEX_Studio1210\cplex\matlab\x64_win64')`
- `setenv('ILOG_CPLEX_PATH', 'C:\Program Files\IBM\ILOG\CPLEX_Studio1210\cplex\matlab\x64_win64')`

- If CPLEX is correctly installed, you should find "Cplex" command in MATLAB.

3- Installing COBRA Toolbox V3:

3.1. Run MATLAB as administrator

3.2. Double check that the setfield command has only this path "/Applications/MATLAB_R2019b.app/toolbox/matlab/datatypes/setfield.m" by running:

```
> which -all setfield
```

If there are other paths, remove them such as these examples:

```
> rmpath('C:\Program Files\MATLAB\R2019b\toolbox\finance\ftseries\')
> rmpath('C:\Program Files\MATLAB\R2019b\toolbox\sl3d\sl3d\')
```

3.3. Download COBRA toolbox from https://github.com/opencobra/cobratoolbox either using Git (Start > open Git Bash) then run
> git clone --depth=1 https://github.com/opencobra/cobratoolbox.git cobratoolbox
Or manually (not recommended):
> from « Code », click on "Download ZIP"

3.4. Add Cobratoolbox folder to paths using

- `addpath(('/PATH OF THE DOWNLOADED cobratoolbox/'))`

3.5. From MATLAB, go to the downloaded "cobratoolbox" folder, then run

- `initCobraToolbox.m`

3.6 Check if CPLEX is correctly installed and detected by the COBRA Toolbox:

by finding this line during installation **"ibm_cplex active 1 1 1 1"**
And also `changeCobraSolver("ibm_cplex")` should return logical 1

3.7. If MATLAB crashes and closes during installation, open MATLAB and run again the `initCobraToolbox.m` and you might want to double-check that cobratoolbox is still added to the path using which `-all initcobratoolbox`. If the command is not found, repeat step 3.4.

3.8 If Cobratoolbox keeps not recognizing CPLEX after restarting MATLAB with `changeCobraSolver("ibm_cplex")`

Create a MATLAB script "CPLEX_fix.m" and add the next 4 lines:

```
rmpath("C:\Program Files\IBM\ILOG\CPLEX_Studio1210\cplex\matlab\x64_win64")
changeCobraSolver("glpk")
addpath("C:\Program Files\IBM\ILOG\CPLEX_Studio1210\cplex\matlab\x64_win64")
changeCobraSolver("ibm_cplex")
```

It should return logical 1

Copy these 4 lines in the beginning of any COBRAtoolbox scripts.

4- Installing FASTCORE:

Either using Git Bash:

- git clone https://github.com/sysbiolux/rFASTCORMICS

Or manually:

from « Code », click on "Download ZIP"

From MATLAB:

```
addpath(genpath('/PATH OF THE DOWNLOADED rFASTCORMICS/'))
```

If you are able to call the following functions (and more related functions) in the command window of MATLAB then the installation is done.

- fastcc_fastcore *(from the fastcore folder)*
- fastcc_4_fastcormics *(from the fastcormics for microarray data folder)*
- fastcormics_RNAseq *(from the fastcormics for RNA-seq data folder)*

Debugging the installation

Problem: Failed installation with crashing MATLAB

Solution: you may need to remove *cobratoolbox* and *cplex* paths, and add them again using

```
% Restoring all default paths, please note this would remove paths for other non-default
MATLAB tools
restoredefaultpath
% Adding the CPLEX path
addpath('C:\Program Files\IBM\ILOG\CPLEX_Studio1210\cplex\matlab\x64_win64')
setenv('ILOG_CPLEX_PATH','C:\Program
Files\IBM\ILOG\CPLEX_Studio1210\cplex\matlab\x64_win64')
Cplex % should return Logical 1
% Checking if there is only this path for setfield command:
% "/Applications/MATLAB_R2019b.app/toolbox/matlab/datatypes/setfield.m "
which -all setfield
% Saving permanently the new paths
savepath
```

Problem: MATLAB is still not detecting *Cplex* command

1.1 Go to Edit the System Environment Variables (Quickly: enter 'env' in the windows search bar)
Click on Environment Variables...
1.2 In the second box named System variables, check for variables named CPLEX DIR or CPLEX BINARY, click on it and remove it.
Click on New...
1.3 Add the following variable:
Name: ILOG_CPLEX_PATH
Value: /actual/path/to/your/cplex/installation
1.4 Click ok to save the variable.
2.1 Open MATLAB R2019b or below
In the Home/Environment tab, click on Set Path
2.2 Verify that NO path to IBM CPLEX is in the list, else remove it.
At that step, you can also double check that cobratoolbox and rFASTCORMICS folder are properly added.
Click on save to close the Set Path panel.
2.3 In the MATLAB terminal, first load the GLPK solver with changeCobraSolver('glpk'), ignore the warnings.
You should receive the logical 1 as a result.
2.4 Add your actual IBM path to MATLAB with the following code:
addpath('/actual/path/to/your/cplex/installation') (note: genpath is not necessary here and might also be the reason of causing path conflicts)
2.5 Now change the solver to ibm_cplex by using changeCobraSolver('ibm_cplex')
This should give you a logical 1 as answer and you are ready to go.
2.6 Happy modeling.
The steps of 2.1 - 2.3 need to be repeated in each new MATLAB session (from the command window if you are using live script) if you plan to use the ibm_cplex solver.

Problem: Eval errors right after MATLAB startup

1.1 Log in with an admin account.
1.2 Go into C:/Program Files/MATLAB/R2019b/toolbox/local folder and locate the file ‘pathdef.m’
1.3 Copy this file into the C:/Users/Public/Documents folder so that local accounts have access to the file.
1.4 Log out the admin account.
1.5 Log in local account
1.6 Local should go to C:/Users/Public/Documents folder a copy the ‘pathdef.m’ file into their documents MATLAB folder (C:/Users/USERNAME/Documents/MATLAB
1.7 Student can now run MATLAB application without the eval errors.

Note: Paths added with *addpath* or *genpath* are usually added to this pathdef.m file which cannot be guaranteed for this copied pathdef.m file.

Problem: COBRA toolbox is not detecting git during installation

1.1 Go to Edit the System Environment Variables (Quickly: enter 'env' in the windows search bar)

1.2 Click on Environment Variables...
1.3 In the first box named System variables, open “PATH”, then add these 2 paths:
c:\Program Files\Git\bin\git.exe
c:\Program Files\Git\cmd
1.4 Click ok to save the variable.

Problem: Version compatibility (MATLAB is crashing due to version compatibility with CPLEX)
Solution: Other MATLAB guaranteed comptability versions **can be also tested:**
CPLEX 12.10 + MATLAB 2019b (or older till 2015b 8)
CPLEX 12.9 + MATLAB 2018b (or older till 2015b 8)
CPLEX 12.8 + MATLAB 2017b 9.3 (or older till 2015b 8)

Problem: COBRAToolbox folder is detected to be owned by Git
Error message must contain:

- fatal: **detected dubious ownership** in repository at 'C:/Users/cobratoolbox/cobratoolbox-master'

Solution: Run the following code in Git bash

- git config --global --add safe.directory C:/Users/cobratoolbox/cobratoolbox