MFA and Pretrained Acoustic Models

The *Montreal Forced Aligner* (MFA) is a third-party tool developed by Michael McAuliffe and others for time aligning orthographic and phonological forms from a pronunciation dictionary to orthographically transcribed audio files. It is open source software based on the Kaldi ASR toolkit.

LaBB-CAT includes a layer manager module called "MFA Manager" which integrates with MFA in order to facilitate forced alignment of LaBB-CAT corpus data.

The layer manager can work in two modes:

- *Train and Align* - acoustic models are trained on the data you want to align, which can be in any language as long as you have a pronunciation dictionary for it.
- *Pre-trained Models/Dictionaries* - pre-trained models and pronunciation dictionaries are supplied by the Montreal Forced Aligner and used for forced alignment. Languages for which dictionaries are available listed on the MFA website and include:
  - English
  - French
  - German
  - Brazilian Portuguese
  - Spanish
  - Catalan

These instructions assume that your corpus is in one of these languages, and uses the *Pre-trained Models/Dictionaries* approach…

MFA Installation

MFA is not included as part of LaBB-CAT, and so it must be installed on the server you have installed LaBB-CAT on before you can integrate LaBB-CAT with it.

If MFA has not been installed already, please follow the following steps, depending on the operatings system of your LaBB-CAT server:

Linux

To install the Montreal Forced Aligner on Linux systems for all users, so that your web server can access it if required:

1. Download Miniconda:
   `wget https://repo.anaconda.com/miniconda/Miniconda3-py38\_4.10.3-Linux-x86\_64.sh`
2. Start the installer:
   `sudo bash Miniconda3-py38\_4.10.3-Linux-x86\_64.sh`
3. When asked the location to install Miniconda, use:
   `/opt/conda`
4. When asked whether the installer should initialize Miniconda, this is unnecessary so you can respond `no`
5. Change ownership of the conda files):
   `sudo chown -R $USERNAME:$USERNAME /opt/conda`
6. Make conda accessible to all users (so you web server can access MFA):
   `chmod -R go-w /opt/conda`
   `chmod -R go+rX /opt/conda`
7. Install the Montreal Forced Aligner
   `/opt/conda/bin/conda create -n aligner -c conda-forge montreal-forced-aligner=3.2.1`

Windows

To install the Montreal Forced Aligner on Windows systems for all users, so that your web server can access it if required:

1. Download the Miniconda installer: https://repo.anaconda.com/miniconda/Miniconda3-latest-Windows-x86_64.exe
2. Start the installer by double-clicking it.
3. When asked, select the "Install for all users" option. This will install conda somewhere like *C:\ProgramData\Miniconda3*
4. When asked, tick the *add to PATH* option.
5. Install the Montreal Forced Aligner by specifying a path to the environment
   ```
   conda create -c conda-forge -p C:\ProgramData\Miniconda3\envs\aligner
   montreal-forced-aligner=3.2.1
   ```

Windows Troubleshooting

The 3rd party MFA software requires:

- the possibility of running command-line programs during installation and forced alignement
- the possibility that these programs can download data from the internet

On Windows, this can sometimes be complicated by the fact that Apache Tomcat and LaBB-CAT are installed as a 'Windows Service'. Windows Services usually run using the permissions of a special anonymous login account called 'Local System', which in some environments has restricted permissions to access different resources.
If you install the MFA Manager LaBB-CAT integration module, but you find it returns errors when trying to interact with MFA, the problem may be that the Windows Service:

- does not have permission to access the folder where MFA is installed, or
- is not allowed to execute other programs, or
- cannot access the internet.

Sometimes problems can be resolved by:

- running the Apache Tomcat Windows Service as a different user other than 'Local System'. (or if it was running as some other used, try setting it back to 'Local System'), or
- adjusting the permissions of the Windows Service users, or
- adjusting the permissions of the folders where MFA is installed

- configuring the service to use the local Internet Proxy settings to enable connecting to the internet.

PSexec is a tool that can be used to diagnose and solve problems on Windows.

PSexec

1. Download PStool.zip from Microsoft:
   http://technet.microsoft.com/en-us/sysinternals/bb897553.aspx
2. Unzip it
3. Put *PSexec.exe* into `C:\Windows\System32`
4. Open `cmd` using "Run as Administrator"
5. Run the command:
   `Psexec.exe -i -s cmd.exe`
   This opens a new command prompt for local system account
6. In the new command prompt window, check you have the correct account type with the command:
   `whomai`

Then you can use the command prompt to run MFA commands to diagnose errors - e.g.:

- `conda activate montreal-forced-aligner` - activates the MFA environment
- `mfa version` - ensures MFA is installed and accessible, and confirms the version
- `mfa model download dictionary` - ensures MFA can connect to the internet to get models etc.; this command should return a long list of language dictionaries, and not report errors.

Proxy Settings

To update proxy server settings:

1. type `inetcpl.cpl`
2. goto *Connections* tab
3. click on the *LAN Settings* button
4. Fill in the *Proxy* section with the correct details

i Docker Container

If your LaBB-CAT server is installed in a Docker Container, it can download and install Miniconda and MFA itself, as part of the process of installing the MFA Manager LaBB-CAT module.

> There is no need for a separate installation of the MFA software.

Layer Manager Installation

Once MFA has been installed, you have to install the MFA Manager, which is the LaBB-CAT module that provides MFA with all the data it needs, and then saves to alignments MFA produces back to your database.

1. Select the *layer managers* menu option.
2. Follow the *List of layer managers that are not yet installed* link.
3. Find *MFA Manager* in the list, and press its *Install* button and then press *Install* again.
   As long as MFA has been installed for all users, you should see a box that's already filled in with the location that MFA was installed to.
4. Click *Configure* to continue the layer manager installation.
   You will see a window open with some information about integrating with MFA, including the information you've already read above.

Forced Alignment

Once you've

1. Now you need to add a phrase layer for the HTK configuration:

   - **Layer ID**: `mfa`
   - **Type**: *Text*
   - **Alignment**: *Intervals*
   - **Manager**: *MFA Manager*
   - **Generate**: *always*
   - **Description**: *MFA alignment time*

2. When you configure the layer, set the following options:

   - **Dictionary Name**: the dictionary language, e.g. *english_uk_mfa*
   - **Pretrained Acoustic Models**: the models language, e.g. *english_mfa*
   - The rest of the options can be left as their default values.
   - If you're curious about what the configuration options do, hover your mouse over each option to see a 'tool tip' that describes what the option is for.

3. Press *Set Parameters*
4. Press *Regenerate*
   You will see a progress bar while LaBB-CAT force-aligns all the transcripts in the corpus, which may take a few minutes.
5. When the layer manager has finished, you'll see a message saying:
   Complete - words and phones from selected utterances are now aligned.

Tip

Not all MFA pre-trained acoustic models can be used with all dictionaries.
Apart from matching the language (e.g. English-trained acoustic models should be used only with English dictionaries), the phoneme symbol sets must also match.
MFA uses several symbol sets, including:

- IPA - model and dictionary names ending in `...mfa`
- ARPAbet - model and dictionary names ending in `...arpa`

So if you use an acoustic model ending in `...arpa`, then the dictionary you choose must also end in `...arpa`.
See the MFA documentation on models and dictionaries for more detailed information:
https://mfa-models.readthedocs.io