Documentation for XCLASS

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1 Introduction

The program `xclass` is intended to be used as a general manual spectral classification aid, in addition to helping the user to adapt the standard spectrum libraries included with the automatic spectral classification program, MKCLASS, to use with their own spectra. It is always an excellent idea to classify a subset of your spectra manually to establish "ground truth" before unleasing MKCLASS on the entire set.

The program `xclass` runs under a linux environment. To get it to work, you must first download the graphics program `xmk25` and compile and install it on your machine. `xmk25` may be obtained from `http://www.appstate.edu/~grayro/spectrum/ftp/download.html`. You will need to download the Auxilary X-Windows programs for SPECTRUM, as well as the documentation, and compile and install the program `xmk25`.

Once you have gotten `xmk25` working you should download the file `xclass.tar.gz` from the MKCLASS site, untar/ungzip that file, enter the new directory `xclass` and then compile `xclass` with the command:

```
gcc -o xclass xclass.c ffopen.c lum2code.c sp4class.c spt3code.c util.c -lm
```

The executable `xclass` should be moved to the bin directory on your path (for instance, `/usr/local/bin`).

You must also download from the MKCLASS website the spectral library file, `mklib.tar.gz`. This file should be untarred and ungzipped in (preferably) `/usr/local`, but if that is not possible, you can untar it elsewhere and then set the `MKLIB` environment variable to the path to that library. For example, let us suppose that you install the mklib libraries under `/home/username/spectrastuff`. You should set the environment variable `MKLIB` to `"/home/username/spectrastuff/mkclass"`. Where that is done depends on your operating system. It might be in the file `.bashrc`, or the file `.profile`; ask your system administrator or look it up on google. In any case, at the end of that file you should put the line:

```
Export MKLIB="/home/username/spectrastuff/mkclass"
```

2 Operation

The operation of the `xclass` program is fairly intuitive. When you run `xclass`, it will first prompt you for the standard spectrum library. To this you can answer with the name of one of the libraries in `mklib`, for instance, `libnor36` or `libr18`. For more information on those libraries (and how you can make your own, or how you can adapt them to the particular resolution of your own spectra), please see the documentation for MKCLASS.

Once you have defined the library, `xclass` gives you a menu of options:

```
Enter selection:

1) Display unknown only
2) Display unknown with one standard
3) Display unknown with two standards
4) Exit program
```

You should first select (1). This will prompt you for the name of the spectrum file (note, all spectra must be in ascii format with the first column the wavelength in ångstroms, and the rectified or normalized flux in the second). The normalized flux standard star spectra are all normalized to unity at the wavelength 4503Å, and your flux spectra should likewise be normalized at the same wavelength. For more details on the format and wavelength range of the spectrum files, see the MKCLASS documentation. Once you enter the spectrum file name, this option will display your spectrum using the program `xmk25`. To get back into the main `xclass` menu, press "quit" on the `xmk25` window. Now choose option (2). This will again prompt you for the spectrum file name, but if you are still working on the one you originally entered, simply pressing "enter" will select that file. You will also be prompted for the standard spectral type that you wish to compare your spectrum with. This should be of the format A3 IV, with a space between the temperature type and the luminosity type. The temperature types permitted are all (integer) types between O6 and M5, although the real range will depend on the standard spectrum library you have selected. Luminosity types allowed are:

```
V, IV-V, IV, III-IV, III, II-III, II, Ib-II, Ib, Ia
```

You will also be asked for an offset; if you enter 0, the unknown and the standard star spectrum will be plotted on top of each other. 0.5 will separate them by 0.5 units in the flux, etc.

If you take option (3), you will be prompted for two spectral types, and then the display will show the two standard spectra with your program spectrum sandwiched in between.

If you have questions about the operation of the program, please contact Richard Gray at grayro@appstate.edu.

3   XCLASS and Windows

I have received queries about how to use XCLASS under MS Windows. To do this, it is necessary to first install Cygwin (`https://www.cygwin.com/`), which gives you a linux environment running ontop of Windows. When you install Cygwin, be certain to install the following packages:

```
gcc compiler
xorg-dev
xinit
xterm
```

Using the instructions above, you must first install `xmk25`, and then `xclass`. The binaries may be moved to `/usr/local/bin` under Cygwin. Likewise, install `mklib.tar.gz` in `/usr/local`. To run `xclass` under Cygwin, start the xserver with
```
startxwin &
```
Wait until it runs successfully, and check whether `DISPLAY=:1.0` or `:0.0` appears in the `startwin` log output (`startxwin` is in `/usr/bin`, and sets `DISPLAY` to be the first display free, beginning with `:0..`

If you've run `startwin` before, and closed it, the next time `startwin` is run, the display will be `:1.0`. This increases by one for further restarts. Then hit return to get the prompt again.
Launch an xterminal with
```
DISPLAY=:0.0 xterm -rv -sb &
```

In the `xterm` change to the directory with your spectra, then run `xclass` as described above in section 2, with just
```
xclass
```
You can also run `xmk25` with
```
xmk25
```
(Thanks to Chris Corbally for the above directions).