Documentation of `redmonster` Output Files

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1 Introduction

This document is intended to describe the format and contents of the files generated by the `redmonster` software.

The principal output of the software is the *redmonster* file. It contains the all of the spectroscopic redshift and classification information, as well as the models used for the fits. This file is described in §2.

The default behavior of the software is to not store the χ^2 surfaces generated by the fitting routines. However, the software does provide the option to write these surfaces to a separate *chi2arr* file. This file is described in §3.

2 *redmonster* File

2.1 Naming convention

Primary output files from `redmonster` will generally follow the naming scheme

redmonster-pppp-mmmmm.fits

where *pppp* is the 4-digit SDSS plate number, and *mmmmm* is the 5-digit MJD. These correspond with the *spPlate* input file and and cannot be changed by the user.

In the case where a file with the above naming convention exists in the specified directory, the default behavior of the software is to overwrite it. However, the user may elect to leave the older file intact, in which case the new file will be written as

redmonster-pppp-mmmmm-YYYY-nn-dd_HH:MM:SS.fits

where *YYYY*, *nn*, *dd*, *HH*, *MM*, and *SS* are the year, month, day, hour, minute, and second, respectively, of the time (GMT) at which the file was written.

2.2 File type

All `redmonster` outputs are uncompressed FITS files with all relevant information in the primary HDU header and the first and second BIN tables. The file size is approximately 20 MB.

2.3 File structure

The general structure of the file is as follows:

HDU0	NULL	Empty
HDU1	Binary FITS Table	Object redshifts and classifications
HDU2	`nfibers` $\times$ `npix` float image	Best-fit template model for each object

2.4 Header

The primary HDU header is nearly identical to that of the *spPlate* files[1], with a few minor additions specific to `redmonster`. Those additions are as follows:

VERSION_RM	Version of `redmonster` that produced the file
DATE_RM	Date and time (GMT) of `redmonster` completion

[1]Documented at http://data.sdss3.org/datamodel/index-files.html

2.5 Binary tables

The first binary FITS table contains all redshift and classification information. The data included is as follows, specified by the binary table's header:

Z1	Best redshift (least χ^2_r)
Z2	Second best redshift
Z_ERR1	1-σ error associated with Z1
Z_ERR2	1-σ error associated with Z2
CLASS	Object type classification
SUBCLASS	Best-fit template parameters
FIBERID	*spPlate* fiber numbers used (0-based)
MINVECTOR	Coordinates of best-fit template in *ndArch* file
ZWARNING	Warning flags (identical to BOSS flags)
DOF	Degrees of freedom used in calculating χ^2_r
NPOLY	Number of additive polynomials used
FNAME	Full name of *ndArch* file of best-fit template

In some cases (failure of fit, small $\Delta\chi^2$, etc.), redshift values have been set to -1. In these cases, the associated errors have also been set to -1.

The second binary FITS table contains an `nfibers` $\times$ `npix` float image comprised of the best-fit models (template + polynomials at global minimum of χ^2 surface) for each fiber. The models are in units of $10^{-17} erg\ cm^{-2} s^{-1} \mathring{A}^{-1}$

Details for this part still need to be filled in once `io.py` is edited to write the models as well - I haven't gotten around to doing that yet.

3 *chi2arr* File

3.1 Naming convention

The *chi2arr* file follows the naming scheme

chi2arr-ttttttttttt-pppp-mmmmm.fits

where *ttttttttttt* is the template's type (derived from the *ndArch* file), *pppp* is the 4-digit SDSS plate number, and *mmmmm* is the 5-digit MJD. As above, plate and MJD are taken from the input *spPlate* file. Currently, there is no secondary naming scheme, and older *chi2arr* files will be overwritten.

3.2 File Type

All `chi2arr` files are in the uncompressed FITS format. All data is located in the primary HDU.

The file size varies depending on number of template parameters and redshift range, but can quickly become large. For example, fitting 300 templates to 595 fibers at 3469 redshifts results in a 4.7 GB file.

3.3 File structure

The primary HDU contains a `numpy` array of χ^2 values, of dimensions
$\texttt{nfibers} \times \texttt{npar}_1 \times ... \times \texttt{npar}_N \times \texttt{n}_z$,
where $\texttt{npar}_i$ is the length of the i^{th} parameter dimension and $\texttt{n}_z$ is the number of redshifts explored.

There is no information in the header.