The GNU libextractor Reference Manual

Version 1.0.0
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This manual is for GNU libextractor (version 1.0.0, 8 September 2012), a library for metadata extraction.

Short Contents

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1 Introduction

GNU libextractor is GNU's library for extracting meta data from files. Meta data includes format information (such as mime type, image dimensions, color depth, recording frequency), content descriptions (such as document title or document description) and copyright information (such as license, author and contributors). Meta data extraction is an inherently uncertain business — a parse error can be a corrupt file, an incompatibility in the file format version, an entirely different file format or a bug in the parser. As a result of this uncertainty, GNU libextractor deliberately avoids to ever report any errors. Unexpected file contents simply result in less or possibly no meta data being extracted.

GNU libextractor uses plugins to handle various file formats. Technically a plugin can support multiple file formats; however, most plugins only support one particular format. By default, GNU libextractor will use all plugins that are available and found in the plugin installation directory. Applications can request the use of only specific plugins or the exclusion of certain plugins.

GNU libextractor is distributed with the `extract` command[1] which is a command-line tool for extracting meta data. `extract` is given a list of filenames and prints the resulting meta data to the console. The `extract` source code also serves as an advanced example for how to use GNU libextractor.

This manual focuses on providing documentation for writing software with GNU libextractor. The only relevant parts for end-users are the chapter on compiling and installing GNU libextractor (See Chapter 2 [Preparation], page 2.). Also, the chapter on existing plugins maybe of interest (See Chapter 7 [Existing Plugins], page 15.). Additional documentation for end-users can be find in the man page on `extract` (using `man extract`).

[1] Some distributions ship `extract` in a seperate package.

2 Preparation

This chapter first describes the general build instructions that should apply to all systems. Specific instructions for known problems for particular platforms are then described in individual sections afterwards.

Compiling GNU libextractor follows the standard GNU autotools build process using `configure` and `make`. For details on the GNU autotools build process, read the '`INSTALL`' file and query `./configure --help` for additional options.

GNU libextractor has various dependencies, most of which are optional. Instead of specifying the names of the software packages, we will give the list in terms of the names of the respective Debian (wheezy) packages that should be installed.

You absolutely need:

- libtool
- gcc
- make
- g++
- libltdl7-dev

Recommended dependencies are:

- zlib1g-dev
- libbz2-dev
- libgif-dev
- libvorbis-dev
- libflac-dev
- libmpeg2-4-dev
- librpm-dev
- libgtk2.0-dev or libgtk3.0-dev
- libgsf-1-dev
- libqt4-dev
- libpoppler-dev
- libexiv2-dev
- libavformat-dev
- libswscale-dev
- libgstreamer1.0-dev

For Subversion access and compilation one also needs:

- subversion
- autoconf
- automake

Please notify us if we missed some dependencies (note that the list is supposed to only list direct dependencies, not transitive dependencies).

Once you have compiled and installed GNU libextractor, you should have a file '`extractor.h`' installed in your '`include/`' directory. This file should be the starting point for your C and C++ development with GNU libextractor. The build process also installs the '`extract`' binary and man pages for '`extract`' and GNU libextractor. The '`extract`' man page documents the '`extract`' tool. The GNU libextractor man page gives a brief summary of the C API for GNU libextractor.

When you install GNU libextractor, various plugins will be installed in the '`lib/libextractor/`' directory. The main library will be installed as '`lib/libextractor.so`'. Note that GNU libextractor will attempt to find the plugins relative to the path of the main library. Consequently, a package manager can move the library and its plugins to a different location later — as long as the relative path between the main library and the plugins is preserved. As a method of last resort, the user can specify an environment variable `LIBEXTRACTOR_PREFIX`. If GNU libextractor cannot locate a plugin, it will look in `LIBEXTRACTOR_PREFIX/lib/libextractor/`.

2.1 Installation on GNU/Linux

Should work using the standard instructions without problems.

2.2 Installation on FreeBSD

Should work using the standard instructions without problems.

2.3 Installation on OpenBSD

OpenBSD 3.8 also doesn't have CODESET in '`langinfo.h`'. CODESET is used in GNU libextractor in about three places. This causes problems during compilation.

2.4 Installation on NetBSD

No reports so far.

2.5 Installation using MinGW

Linking -lstdc++ with the provided libtool fails on Cygwin, this is a problem with libtool, there is unfortunately no flag to tell libtool how to do its job on Cygwin and it seems that it cannot be the default to set the library check to 'pass_all'. Patching libtool may help.

Note: this is a rather dated report and may no longer apply.

2.6 Installation on OS X

libextractor has two installation methods on Mac OS X: it can be installed as a Mac OS X framework or with the standard `./configure; make; make install` shell commands. The framework package is self-contained, but currently omits some of the extractor plugins that can be compiled in if libextractor is installed with `./configure; make; make install` (provided that the required dependencies exist.)

2.6.1 Installing and uninstalling the framework

The binary framework is distributed as a disk image ('`Extractor-x.x.xx.dmg`'). Installation is done by opening the disk image and clicking '`Extractor.pkg`' inside it. The Mac

OS X installer application will then run. The framework is installed to the root volume's '`/Library/Frameworks`' folder and installing will require admin privileges.

The framework can be uninstalled by dragging '`/Library/Frameworks/Extractor.framework`' to the '`Trash`'.

2.6.2 Using the framework

In the framework, the `extract` command line tool can be found at '`/Library/Frameworks/Extractor.framework/Versions/Current/bin/extract`'

The framework can be used in software projects as a framework or as a dynamic library.

When using the framework as a dynamic library in projects using autotools, one would most likely want to add "-I/Library/Frameworks/Extractor.framework/Versions/Current/include" to CPPFLAGS and "-L/Library/Frameworks/Extractor.framework/Versions/Current/lib" to LDFLAGS.

2.6.3 Example for using the framework

```
// hello.c
#include <Extractor/extractor.h>

int
main (int argc, char **argv)
{
  struct EXTRACTOR_PluginList *el;
  el = EXTRACTOR_plugin_load_defaults (EXTRACTOR_OPTION_DEFAULT_POLICY);
  // ...
  EXTRACTOR_plugin_remove_all (el);
  return 0;
}
```

You can then compile the example using

```
$ gcc -o hello hello.c -framework Extractor
```

2.6.4 Example for using the dynamic library

```
// hello.c
#include <extractor.h>
int main()
{
  struct EXTRACTOR_PluginList *el;
  el = EXTRACTOR_plugin_load_defaults (EXTRACTOR_OPTION_DEFAULT_POLICY);
  // ...
  EXTRACTOR_plugin_remove_all (el);
  return 0;
}
```

You can then compile the example using

```
$ gcc -I/Library/Frameworks/Extractor.framework/Versions/Current/include \
  -o hello hello.c \
```

```
-L/Library/Frameworks/Extractor.framework/Versions/Current/lib \
-lextractor
```

Notice the difference in the `#include` line.

2.7 Note to package maintainers

The suggested way to package GNU libextractor is to split it into roughly the following binary packages:

- libextractor (main library only, only hard dependency for other packages depending on GNU libextractor)
- extract (command-line tool and man page extract.1)
- libextractor-dev (extractor.h header and man page libextractor.3)
- libextractor-doc (this manual)
- libextractor-plugins (plugins without external dependencies; recommended but not required by extract and libextractor package)
- libextractor-plugin-XXX (plugin with dependency on libXXX, for example for XXX=mpeg this would be '`libextractor_mpeg.so`')
- libextractor-plugins-all (meta package that requires all plugins except experimental plugins)

This would enable minimal installations (i.e. for embedded systems) to not include any plugins, as well as moderate-size installations (that do not trigger GTK and X11) for systems that have limited resources. Right now, the MP4 plugin is experimental and does nothing and should thus never be included at all. The gstreamer plugin is experimental but largely works with the correct version of gstreamer and can thus be packaged (especially if the dependency is available on the target system) but should probably not be part of libextractor-plugins-all.

3 Generalities

3.1 Introduction to the “extract” command

The `extract` command takes a list of file names as arguments, extracts meta data from each of those files and prints the result to the console. By default, `extract` will use all available plugins and print all (non-binary) meta data that is found.

The set of plugins used by `extract` can be controlled using the “-l” and “-n” options. Use “-n” to not load all of the default plugins. Use “-l NAME” to specifically load a certain plugin. For example, specify “-n -l mime” to only use the MIME plugin.

Using the “-p” option the output of `extract` can be limited to only certain keyword types. Similarly, using the “-x” option, certain keyword types can be excluded. A list of all known keyword types can be obtained using the “-L” option.

The output format of `extract` can be influenced with the “-V” (more verbose, lists filenames), “-g” (grep-friendly, all meta data on a single line per file) and “-b” (bibTeX style) options.

3.2 Common usage examples for “extract”

```
$ extract test/test.jpg
comment - (C) 2001 by Christian Grothoff, using gimp 1.2 1
mimetype - image/jpeg

$ extract -V -x comment test/test.jpg
Keywords for file test/test.jpg:
mimetype - image/jpeg

$ extract -p comment test/test.jpg
comment - (C) 2001 by Christian Grothoff, using gimp 1.2 1

$ extract -nV -l png.so -p comment test/test.jpg test/test.png
Keywords for file test/test.jpg:
Keywords for file test/test.png:
comment - Testing keyword extraction
```

3.3 Introduction to the libextractor library

Each public symbol exported by GNU libextractor has the prefix `EXTRACTOR_`. All-caps names are used for constants. For the impatient, the minimal C code for using GNU libextractor (on the executing binary itself) looks like this:

```
#include <extractor.h>

int
main (int argc, char ** argv)
{
  struct EXTRACTOR_PluginList *plugins
```

```
    = EXTRACTOR_plugin_add_defaults (EXTRACTOR_OPTION_DEFAULT_POLICY);
  EXTRACTOR_extract (plugins, argv[1],
                     NULL, 0,
                     &EXTRACTOR_meta_data_print, stdout);
  EXTRACTOR_plugin_remove_all (plugins);
  return 0;
}
```

The minimal API illustrated by this example is actually sufficient for many applications. The full external C API of GNU libextractor is described in chapter See Chapter 4 [Extracting meta data], page 8. Bindings for other languages are described in chapter See Chapter 5 [Language bindings], page 12. The API for writing new plugins is described in chapter See Chapter 8 [Writing new Plugins], page 16.

4 Extracting meta data

In order to extract meta data with GNU libextractor you first need to load the respective plugins and then call the extraction API with the plugins and the data to process. This section documents how to load and unload plugins, the various types and formats in which meta data is returned to the application and finally the extraction API itself.

4.1 Plugin management

Using GNU libextractor from a multi-threaded parent process requires some care. The problem is that on most platforms GNU libextractor starts sub-processes for the actual extraction work. This is useful to isolate the parent process from potential bugs; however, it can cause problems if the parent process is multi-threaded. The issue is that at the time of the fork, another thread of the application may hold a lock (i.e. in gettext or libc). That lock would then never be released in the child process (as the other thread is not present in the child process). As a result, the child process would then deadlock on trying to acquire the lock and never terminate. This has actually been observed with a lock in GNU gettext that is triggered by the plugin startup code when it interacts with libltdl.

The problem can be solved by loading the plugins using the `EXTRACTOR_OPTION_IN_PROCESS` option, which will run GNU libextractor in-process and thus avoid the locking issue. In this case, all of the functions for loading and unloading plugins, including `EXTRACTOR_plugin_add_defaults` and `EXTRACTOR_plugin_remove_all`, are thread-safe and reentrant. However, using the same plugin list from multiple threads at the same time is not safe.

All plugin code is expected required to be reentrant and state-less, but due to the extensive use of 3rd party libraries this cannot be guaranteed.

`EXTRACTOR_PluginList` [C Struct]

A plugin list represents a set of GNU libextractor plugins. Most of the GNU libextractor API is concerned with either constructing a plugin list or using it to extract meta data. The internal representation of the plugin list is of no concern to users or plugin developers.

`void EXTRACTOR_plugin_remove_all` (*struct EXTRACTOR_PluginList *plugins*) [Function]

Unload all of the plugins in the given list.

`struct EXTRACTOR_PluginList * EXTRACTOR_plugin_remove` (*struct EXTRACTOR_PluginList *plugins, const char*name*) [Function]

Unloads a particular plugin. The given name should be the short name of the plugin, for example “mime” for the mime-type extractor or “mpeg” for the MPEG extractor.

`struct EXTRACTOR_PluginList * EXTRACTOR_plugin_add` (*struct EXTRACTOR_PluginList *plugins, const char* name,const char* options, enum EXTRACTOR_Options flags*) [Function]

Loads a particular plugin. The plugin is added to the existing list, which can be `NULL`. The second argument specifies the name of the plugin (i.e. “ogg”). The third

argument can be NULL and specifies plugin-specific options. Finally, the last argument specifies if the plugin should be executed out-of-process (EXTRACTOR_OPTION_DEFAULT_POLICY) or not.

struct EXTRACTOR_PluginList * EXTRACTOR_plugin_add_config (*struct EXTRACTOR_PluginList *plugins, const char* config, enum EXTRACTOR_Options flags*) [Function]

Loads and unloads plugins based on a configuration string, modifying the existing list, which can be NULL. The string has the format "[-]NAME(OPTIONS){:[-]NAME(OPTIONS)}*". Prefixing the plugin name with a "-" means that the plugin should be unloaded.

struct EXTRACTOR_PluginList * EXTRACTOR_plugin_add_defaults (*enum EXTRACTOR_Options flags*) [Function]

Loads all of the plugins in the plugin directory. This function is what most GNU libextractor applications should use to setup the plugins.

4.2 Meta types

enum EXTRACTOR_MetaType is a C enum which defines a list of over 100 different types of meta data. The total number can differ between different GNU libextractor releases; the maximum value for the current release can be obtained using the EXTRACTOR_metatype_get_max function. All values in this enumeration are of the form EXTRACTOR_METATYPE_XXX.

const char * EXTRACTOR_metatype_to_string (*enum EXTRACTOR_MetaType type*) [Function]

The function EXTRACTOR_metatype_to_string can be used to obtain a short English string 's' describing the meta data type. The string can be translated into other languages using GNU gettext with the domain set to GNU libextractor (dgettext("libextractor", s)).

const char * EXTRACTOR_metatype_to_description (*enum EXTRACTOR_MetaType type*) [Function]

The function EXTRACTOR_metatype_to_description can be used to obtain a longer English string 's' describing the meta data type. The description may be empty if the short description returned by EXTRACTOR_metatype_to_string is already comprehensive. The string can be translated into other languages using GNU gettext with the domain set to GNU libextractor (dgettext("libextractor", s)).

4.3 Meta formats

enum EXTRACTOR_MetaFormat is a C enum which defines on a high level how the extracted meta data is represented. Currently, the library uses three formats: UTF-8 strings, C strings and binary data. A fourth value, EXTRACTOR_METAFORMAT_UNKNOWN is defined but not used. UTF-8 strings are 0-terminated strings that have been converted to UTF-8. The format code is EXTRACTOR_METAFORMAT_UTF8. Ideally, most text meta data will be of this format. Some file formats fail to specify the encoding used for the text. In this case, the text cannot be converted to UTF-8. However, the meta data is still known to

be 0-terminated and presumably human-readable. In this case, the format code used is `EXTRACTOR_METAFORMAT_C_STRING`; however, this should not be understood to mean that the encoding is the same as that used by the C compiler. Finally, for binary data (mostly images), the format `EXTRACTOR_METAFORMAT_BINARY` is used.

Naturally this is not a precise description of the meta format. Plugins can provide a more precise description (if known) by providing the respective mime type of the meta data. For example, binary image meta data could be also tagged as "image/png" and normal text would typically be tagged as "text/plain".

4.4 Extracting

`int (*EXTRACTOR_MetaDataProcessor)(void` **cls, const char *plugin_name, enum EXTRACTOR_MetaType type, enum EXTRACTOR_MetaFormat format, const char *data_mime_type, const char *data, size_t data_len*) [Function Pointer]

Type of a function that libextractor calls for each meta data item found.

cls closure (user-defined)

plugin_name
name of the plugin that produced this value; special values can be used (i.e. '<zlib>' for zlib being used in the main libextractor library and yielding meta data);

type libextractor-type describing the meta data;

format basic
format information about data

data_mime_type
mime-type of data (not of the original file); can be `NULL` (if mime-type is not known);

data actual meta-data found

data_len number of bytes in data

Return 0 to continue extracting, 1 to abort.

`void EXTRACTOR_extract` (*struct EXTRACTOR_PluginList *plugins, const char *filename, const void *data, size_t size, EXTRACTOR_MetaDataProcessor proc, void *proc_cls*) [Function]

This is the main function for extracting keywords with GNU libextractor. The first argument is a plugin list which specifies the set of plugins that should be used for extracting meta data. The '`filename`' argument is optional and can be used to specify the name of a file to process. If '`filename`' is `NULL`, then the '`data`' argument must point to the in-memory data to extract meta data from. If '`filename`' is non-`NULL`, '`data`' can be `NULL`. If '`data`' is non-null, then '`size`' is the size of '`data`' in bytes. Otherwise '`size`' should be zero. For each meta data item found, GNU libextractor will call the '`proc`' function, passing '`proc_cls`' as the first argument to '`proc`'. The other arguments to '`proc`' depend on the specific meta data found.

Meta data extraction should never really fail — at worst, GNU libextractor should not call '`proc`' with any meta data. By design, GNU libextractor should never crash or leak memory, even given corrupt files as input. Note however, that running GNU libextractor on a corrupt file system (or incorrectly `mmap`ed files) can result in the operating system sending a SIGBUS (bus error) to the process. While GNU libextractor runs plugins out-of-process, it first maps the file into memory and then attempts to decompress it. During decompression it is possible to encounter a SIGBUS. GNU libextractor will *not* attempt to catch this signal and your application is likely to crash. Note again that this should only happen if the file *system* is corrupt (not if individual files are corrupt). If this is not acceptable, you might want to consider running GNU libextractor itself also out-of-process (as done, for example, by doodle).

5 Language bindings

GNU libextractor works immediately with C and C++ code. Bindings for Java, Mono, Ruby, Perl, PHP and Python are available for download from the main GNU libextractor website. Documentation for these bindings (if available) is part of the downloads for the respective binding. In all cases, a full installation of the C library is required before the binding can be installed.

5.1 Java

Compiling the GNU libextractor Java binding follows the usual process of running `configure` and `make`. The result will be a shared C library '`libextractor_java.so`' with the native code and a JAR file (installed to '`$PREFIX/share/java/libextractor.java`').

A minimal example for using GNU libextractor's Java binding would look like this:

```
import org.gnu.libextractor.*;
import java.util.ArrayList;

public static void main(String[] args) {
  Extractor ex = Extractor.getDefault();
  for (int i=0;i<args.length;i++) {
    ArrayList keywords = ex.extract(args[i]);
    System.out.println("Keywords for " + args[i] + ":");
    for (int j=0;j<keywords.size();j++)
      System.out.println(keywords.get(j));
  }
}
```

The GNU libextractor library and the '`libextractor_java.so`' JNI binding have to be in the library search path for this to work. Furthermore, the '`libextractor.jar`' file should be on the classpath.

Note that the API does not use Java 5 style generics in order to work with older versions of Java.

5.2 Mono

his binding is undocumented at this point.

5.3 Perl

This binding is undocumented at this point.

5.4 Python

This binding is undocumented at this point.

5.5 PHP

This binding is undocumented at this point.

5.6 Ruby

This binding is undocumented at this point.

6 Utility functions

This chapter describes various utility functions for GNU libextractor usage. All of the functions are reentrant.

6.1 Utility Constants

The constant `EXTRACTOR_VERSION` is a hexadecimal representation of the version number of the installed libextractor header. The hexadecimal format is 0xAABBCCDD where AA is the major version (so far always 0), BB is the minor version, CC is the revision and DD the patch number. For example, for version 0.5.18, we would have AA=0, BB=5, CC=18 and DD=0. Minor releases such as 0.5.18a or significant changes in unreleased versions would be marked with DD=1 or higher.

6.2 Meta data printing

The `EXTRACTOR_meta_data_print` is a simple function which prints the meta data found with libextractor to a file. The function is mostly useful for debugging and as an example for how to manipulate the keyword list and can be passed as the '`proc`' argument to `EXTRACTOR_extract`. The file to print to should be passed as '`proc_cls`' (which must be of type `FILE *`), for example `stdout`.

7 Existing Plugins

- ARCHIVE (using libarchive)
- DVI
- EXIV2 (using libexiv2, 0.23 or later preferred)
- FLAC (using libFLAC)
- GIF (using libgif)
- GSTREAMER (using libgstreamer v1.0 or later)
- HTML (using libtidy)
- IT
- JPEG (using libjpeg v8 or later)
- MAN
- MIDI (using libsmf)
- MIME (using libmagic)
- MPEG (using libmpeg2)
- NSF
- NSFE
- ODF
- OLE2 (with libgsf)
- OGG (with libogg)
- PNG
- PS
- RIFF
- RPM (using librpm)
- S3M
- SID
- ThumbnailFFMPEG (using libavformat and related libav-libraries, including libswscale)
- ThumbnailGtk (using libgtk)
- TIFF (with libtiff, tested with v4)
- WAV
- XM
- ZIP

'`gzip`' and '`bzip2`' compressed versions of these formats are also supported (as well as meta data embedded by '`gzip`' itself) if zlib or libbz2 are available.

8 Writing new Plugins

Writing a new plugin for libextractor usually requires writing of or interfacing with an actual parser for a specific format. How this is can be accomplished depends on the format and cannot be specified in general. However, care should be taken for the code to be reentrant and highly fault-tolerant, especially with respect to malformed inputs.

Plugins should start by verifying that the header of the data matches the specific format and immediately return if that is not the case. Even if the header matches the expected file format, plugins must not assume that the remainder of the file is well formed.

The plugin library must be called libextractor_XXX.so, where XXX denotes the file format of the plugin. The library must export a method `libextractor_XXX_extract_method`, with the following signature:

```
void
EXTRACTOR_XXX_extract_method (struct EXTRACTOR_ExtractContext *ec);
```

'`ec`' contains various information the plugin may need for its execution. Most importantly, it contains functions for reading ("read") and seeking ("seek") the input data and for returning extracted data ("proc"). The "config" member can contain additional configuration options. "proc" should be called on each meta data item found. If "proc" returns non-zero, processing should be aborted (if possible).

In order to test new plugins, the '`extract`' command can be run with the options "-ni" and "-l XXX" . This will run the plugin in-process (making it easier to debug) and without any of the other plugins.

8.1 Example for a minimal extract method

The following example shows how a plugin can return the mime type of a file.

```
void
EXTRACTOR_mymime_extract (struct EXTRACTOR_ExtractContext *ec)
{
  void *data;
  ssize_t data_size,

  if (-1 == (data_size = ec->read (ec->cls, &data, 4)))
    return; /* read error */
  if (data_size < 4)
    return; /* file too small */
  if (0 != memcmp (data, "\177ELF", 4))
    return; /* not ELF */
  if (0 != ec->proc (ec->cls,
                     "mymime",
                     EXTRACTOR_METATYPE_MIMETYPE,
                     EXTRACTOR_METAFORMAT_UTF8,
                     "text/plain",
                     "application/x-executable",
                     1 + strlen("application/x-executable")))
    return;
```

```
  /* more calls to 'proc' here as needed */
}
```

9 Internal utility functions

Some plugins link against the `libextractor_common` library which provides common abstractions needed by many plugins. This section documents this internal API for plugin developers. Note that the headers for this library are (intentionally) not installed: we do not consider this API stable and it should hence only be used by plugins that are build and shipped with GNU libextractor. Third-party plugins should not use it.

'`convert_numeric.h`' defines various conversion functions for numbers (in particular, byte-order conversion for floating point numbers).

'`unzip.h`' defines an API for accessing compressed files.

'`pack.h`' provides an interpreter for unpacking structs of integer numbers from streams and converting from big or little endian to host byte order at the same time.

'`convert.h`' provides a function for character set conversion described below.

`char * EXTRACTOR_common_convert_to_utf8` (*const char *input, size_t len, const char *charset*) [Function]

Various GNU libextractor plugins make use of the internal '`convert.h`' header which defines a function

`EXTRACTOR_common_convert_to_utf8` which can be used to easily convert text from any character set to UTF-8. This conversion is important since the linked list of keywords that is returned by GNU libextractor is expected to contain only UTF-8 strings. Naturally, proper conversion may not always be possible since some file formats fail to specify the character set. In that case, it is often better to not convert at all.

The arguments to `EXTRACTOR_common_convert_to_utf8` are the input string (which does *not* have to be zero-terminated), the length of the input string, and the character set (which *must* be zero-terminated). Which character sets are supported depends on the platform, a list can generally be obtained using the `iconv -l` command. The return value from `EXTRACTOR_common_convert_to_utf8` is a zero-terminated string in UTF-8 format. The responsibility to free the string is with the caller, so storing the string in the keyword list is acceptable.

10 Reporting bugs

GNU libextractor uses the Mantis bugtracking system. If possible, please report bugs there. You can also e-mail the GNU libextractor mailinglist at `libextractor@gnu.org`.

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0. PREAMBLE

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