The Independent JPEG Group's JPEG software

README for release 9b of 17-Jan-2016

This distribution contains the ninth public release of the Independent JPEG
Group's free JPEG software. You are welcome to redistribute this software and
to use it for any purpose, subject to the conditions under LEGAL ISSUES, below.

This software is the work of Tom Lane, Guido Vollbeding, Philip Gladstone,
Bill Allombert, Jim Boucher, Lee Crocker, Bob Friesenhahn, Ben Jackson,
Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Ge' Weijers,
and other members of the Independent JPEG Group.

IJG is not affiliated with the ISO/IEC JTC1/SC29/WG1 standards committee
(previously known as JPEG, together with ITU-T SG16).

DOCUMENTATION ROADMAP

This file contains the following sections:

OVERVIEW	General description of JPEG and the IJG software.
LEGAL ISSUES	Copyright, lack of warranty, terms of distribution.
REFERENCES	Where to learn more about JPEG.
ARCHIVE LOCATIONS	Where to find newer versions of this software.
ACKNOWLEDGMENTS	Special thanks.
FILE FORMAT WARS	Software *not* to get.
TO DO	Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:

install.txt	How to configure and install the IJG software.
usage.txt	Usage instructions for cjpeg, djpeg, jpegtran, rdjpgcom, and wrjpgcom.
*.1	Unix-style man pages for programs (same info as usage.txt).
wizard.txt	Advanced usage instructions for JPEG wizards only.
change.log	Version-to-version change highlights.

Programmer and internal documentation:

libjpeg.txt	How to use the JPEG library in your own programs.
example.c	Sample code for calling the JPEG library.
structure.txt	Overview of the JPEG library's internal structure.
filelist.txt	Road map of IJG files.
coderules.txt	Coding style rules --- please read if you contribute code.

Please read at least the files install.txt and usage.txt. Some information
can also be found in the JPEG FAQ (Frequently Asked Questions) article. See
ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or
more of the REFERENCES, then looking at the documentation files (in roughly
the order listed) before diving into the code.

OVERVIEW

This package contains C software to implement JPEG image encoding, decoding,
and transcoding. JPEG (pronounced "jay-peg") is a standardized compression
method for full-color and grayscale images.

This software implements JPEG baseline, extended-sequential, and progressive
compression processes. Provision is made for supporting all variants of these
processes, although some uncommon parameter settings aren't implemented yet.
We have made no provision for supporting the hierarchical or lossless
processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files,
plus two sample applications "cjpeg" and "djpeg", which use the library to
perform conversion between JPEG and some other popular image file formats.
The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included
considerable functionality beyond the bare JPEG coding/decoding capability;
for example, the color quantization modules are not strictly part of JPEG
decoding, but they are essential for output to colormapped file formats or
colormapped displays. These extra functions can be compiled out of the
library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between
different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple
applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and
flexibility, while also making it fast enough to be useful. In particular,
the software is not intended to be read as a tutorial on JPEG. (See the
REFERENCES section for introductory material.) Rather, it is intended to
be reliable, portable, industrial-strength code. We do not claim to have
achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products.
No royalty is required, but we do ask for an acknowledgement in product
documentation, as described under LEGAL ISSUES.

LEGAL ISSUES

In plain English:

1. We don't promise that this software works. (But if you find any bugs,
   please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a
   program, you must acknowledge somewhere in your documentation that
   you've used the IJG code.

In legalese:

The authors make NO WARRANTY or representation, either express or implied,
with respect to this software, its quality, accuracy, merchantability, or
fitness for a particular purpose. This software is provided "AS IS", and you,
its user, assume the entire risk as to its quality and accuracy.

Permission is hereby granted to use, copy, modify, and distribute this
software (or portions thereof) for any purpose, without fee, subject to these
conditions:
(1) If any part of the source code for this software is distributed, then this
README file must be included, with this copyright and no-warranty notice
unaltered; and any additions, deletions, or changes to the original files
must be clearly indicated in accompanying documentation.
(2) If only executable code is distributed, then the accompanying
documentation must state that "this software is based in part on the work of

the Independent JPEG Group".
(3) Permission for use of this software is granted only if the user accepts
full responsibility for any undesirable consequences; the authors accept
NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code,
not just to the unmodified library. If you use our work, you ought to
acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name
in advertising or publicity relating to this software or products derived from
it. This software may be referred to only as "the Independent JPEG Group's
software".

We specifically permit and encourage the use of this software as the basis of
commercial products, provided that all warranty or liability claims are
assumed by the product vendor.

The Unix configuration script "configure" was produced with GNU Autoconf.
It is copyright by the Free Software Foundation but is freely distributable.
The same holds for its supporting scripts (config.guess, config.sub,
ltmain.sh). Another support script, install-sh, is copyright by X Consortium
but is also freely distributable.

The IJG distribution formerly included code to read and write GIF files.
To avoid entanglement with the Unisys LZW patent (now expired), GIF reading
support has been removed altogether, and the GIF writer has been simplified
to produce "uncompressed GIFs". This technique does not use the LZW
algorithm; the resulting GIF files are larger than usual, but are readable
by all standard GIF decoders.

REFERENCES
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We recommend reading one or more of these references before trying to
understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm is

      Wallace, Gregory K. "The JPEG Still Picture Compression Standard",
      Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44.

(Adjacent articles in that issue discuss MPEG motion picture compression, applications of JPEG, and related topics.) If you don't have the CACM issue handy, a PDF file containing a revised version of Wallace's article is available at http://www.ijg.org/files/Wallace.JPEG.pdf. The file (actually a preprint for an article that appeared in IEEE Trans. Consumer Electronics) omits the sample images that appeared in CACM, but it includes corrections and some added material. Note: the Wallace article is copyright ACM and IEEE, and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in "The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides good explanations and example C code for a multitude of compression methods including JPEG. It is an excellent source if you are comfortable reading C code but don't know much about data compression in general. The book's JPEG sample code is far from industrial-strength, but when you are ready to look at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still Image Data Compression Standard" by William B. Pennebaker and Joan L. Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1. Price US$59.95, 638 pp. The book includes the complete text of the ISO JPEG standards (DIS 10918-1 and draft DIS 10918-2).
Although this is by far the most detailed and comprehensive exposition of JPEG publicly available, we point out that it is still missing an explanation of the most essential properties and algorithms of the underlying DCT technology.
If you think that you know about DCT-based JPEG after reading this book, then you are in delusion. The real fundamentals and corresponding potential of DCT-based JPEG are not publicly known so far, and that is the reason for all the mistaken developments taking place in the image coding domain.

The original JPEG standard is divided into two parts, Part 1 being the actual specification, while Part 2 covers compliance testing methods. Part 1 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS

10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 2: Compliance testing" and has document numbers ISO/IEC IS 10918-2, ITU-T T.83.
IJG JPEG 8 introduced an implementation of the JPEG SmartScale extension which is specified in two documents: A contributed document at ITU and ISO with title "ITU-T JPEG-Plus Proposal for Extending ITU-T T.81 for Advanced Image Coding", April 2006, Geneva, Switzerland. The latest version of this document is Revision 3. And a contributed document ISO/IEC JTC1/SC29/WG1 N 5799 with title "Evolution of JPEG", June/July 2011, Berlin, Germany.
IJG JPEG 9 introduces a reversible color transform for improved lossless compression which is described in a contributed document ISO/IEC JTC1/SC29/ WG1 N 6080 with title "JPEG 9 Lossless Coding", June/July 2012, Paris, France.

The JPEG standard does not specify all details of an interchangeable file format. For the omitted details we follow the "JFIF" conventions, version 2.
JFIF version 1 has been adopted as Recommendation ITU-T T.871 (05/2011) : Information technology - Digital compression and coding of continuous-tone still images: JPEG File Interchange Format (JFIF). It is available as a free download in PDF file format from http://www.itu.int/rec/T-REC-T.871. A PDF file of the older JFIF document is available at http://www.w3.org/Graphics/JPEG/jfif3.pdf.

The TIFF 6.0 file format specification can be obtained by FTP from ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz. The JPEG incorporation scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems. IJG does not recommend use of the TIFF 6.0 design (TIFF Compression tag 6).
Instead, we recommend the JPEG design proposed by TIFF Technical Note #2 (Compression tag 7). Copies of this Note can be obtained from http://www.ijg.org/files/. It is expected that the next revision of the TIFF spec will replace the 6.0 JPEG design with the Note's design. Although IJG's own code does not support TIFF/JPEG, the free libtiff library uses our library to implement TIFF/JPEG per the Note.

ARCHIVE LOCATIONS

The "official" archive site for this software is www.ijg.org. The most recent released version can always be found there in directory "files". This particular version will be archived as http://www.ijg.org/files/jpegsrc.v9b.tar.gz, and in Windows-compatible "zip" archive format as http://www.ijg.org/files/jpegsr9b.zip.

The JPEG FAQ (Frequently Asked Questions) article is a source of some general information about JPEG.
It is available on the World Wide Web at http://www.faqs.org/faqs/jpeg-faq/
and other news.answers archive sites, including the official news.answers archive at rtfm.mit.edu: ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/.
If you don't have Web or FTP access, send e-mail to mail-server@rtfm.mit.edu
with body
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send usenet/news.answers/jpeg-faq/part1
send usenet/news.answers/jpeg-faq/part2
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Thank to Juergen Bruder for providing me with a copy of the common DCT algorithm article, only to find out that I had come to the same result in a more direct and comprehensible way with a more generative approach.

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Thank to Thomas Wiegand and Gary Sullivan for inviting me to the Joint Video Team (MPEG & ITU) meeting in Geneva, Switzerland.

Thank to Thomas Richter and Daniel Lee for inviting me to the ISO/IEC JTC1/SC29/WG1 (previously known as JPEG, together with ITU-T SG16)
meeting in Berlin, Germany.

Thank to John Korejwa and Massimo Ballerini for inviting me to fruitful consultations in Boston, MA and Milan, Italy.

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Thank to Andrew Finkenstadt for hosting the ijg.org site.

Last but not least special thank to Thomas G. Lane for the original design and development of this singular software package.

FILE FORMAT WARS

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The ISO/IEC JTC1/SC29/WG1 standards committee (previously known as JPEG, together with ITU-T SG16) currently promotes different formats containing the name "JPEG" which is misleading because these formats are incompatible
with original DCT-based JPEG and are based on faulty technologies.
IJG therefore does not and will not support such momentary mistakes (see REFERENCES).
There exist also distributions under the name "OpenJPEG" promoting such kind of formats which is misleading because they don't support original JPEG images.
We have no sympathy for the promotion of inferior formats. Indeed, one of
the original reasons for developing this free software was to help force convergence on common, interoperable format standards for JPEG files.
Don't use an incompatible file format!
(In any case, our decoder will remain capable of reading existing JPEG image files indefinitely.)

The ISO committee pretends to be "responsible for the popular JPEG" in their
public reports which is not true because they don't respond to actual requirements for the maintenance of the original JPEG specification.
Furthermore, the ISO committee pretends to "ensure interoperability" with their standards which is not true because their "standards" support only application-specific and proprietary use cases and contain mathematically incorrect code.

There are currently different distributions in circulation containing the name "libjpeg" which is misleading because they don't have the features and
are incompatible with formats supported by actual IJG libjpeg distributions.
One of those fakes is released by members of the ISO committee and just uses
the name of libjpeg for misdirection of people, similar to the abuse of the
name JPEG as described above, while having nothing in common with actual IJG
libjpeg distributions and containing mathematically incorrect code.
The other one claims to be a "derivative" or "fork" of the original libjpeg,
but violates the license conditions as described under LEGAL ISSUES above and violates basic C programming properties.
We have no sympathy for the release of misleading, incorrect and illegal distributions derived from obsolete code bases.
Don't use an obsolete code base!

According to the UCC (Uniform Commercial Code) law, IJG has the lawful and
legal right to foreclose on certain standardization bodies and other institutions or corporations that knowingly perform substantial and

systematic deceptive acts and practices, fraud, theft, and damaging of the
value of the people of this planet without their knowing, willing and intentional consent.
The titles, ownership, and rights of these institutions and all their assets
are now duly secured and held in trust for the free people of this planet.
People of the planet, on every country, may have a financial interest in the assets of these former principals, agents, and beneficiaries of the foreclosed institutions and corporations.
IJG asserts what is: that each man, woman, and child has unalienable value
and rights granted and deposited in them by the Creator and not any one of
the people is subordinate to any artificial principality, corporate fiction
or the special interest of another without their appropriate knowing, willing and intentional consent made by contract or accommodation agreement.
IJG expresses that which already was.
The people have already determined and demanded that public administration
entities, national governments, and their supporting judicial systems must
be fully transparent, accountable, and liable.
IJG has secured the value for all concerned free people of the planet.

A partial list of foreclosed institutions and corporations ("Hall of Shame")
is currently prepared and will be published later.

TO DO
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Version 9 is the second release of a new generation JPEG standard
to overcome the limitations of the original JPEG specification,
and is the first true source reference JPEG codec.
More features are being prepared for coming releases...

Please send bug reports, offers of help, etc. to jpeg-info@jpegclub.org.