

New file carver

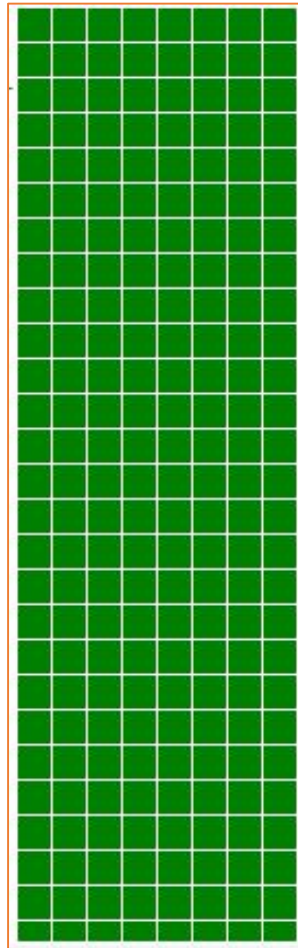
Igor Loskutov - Rusolut

Ideal case

NAND memory device



ECC map



No lost blocks

Markers table 0

| Block markers | | | | | | | Page markers | |
|-------------------------------------|------|------|--------|------------|--------------------------|--------------------------|--------------|---------|
| Use | Bank | LBN | Header | Address | LB | RB | LPN | Address |
| <input checked="" type="checkbox"/> | 00 | 1000 | FF | 0108114000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1001 | FF | 00A2F30000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1002 | FF | 00A206C000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1003 | FF | 010A4F0000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1004 | FF | 00A3368000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1005 | FF | 010C278000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1006 | FF | 0107688000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1007 | FF | 010A928000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1010 | FF | 0106E18000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1011 | FF | 0109A64000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1012 | FF | 010DBC8000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1013 | FF | 010B5D0000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1014 | FF | 0108FD8000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1015 | FF | 010A0B8000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1016 | FF | 0107CDC000 | <input type="checkbox"/> | <input type="checkbox"/> | | |
| <input checked="" type="checkbox"/> | 00 | 1017 | FF | 010C05C000 | <input type="checkbox"/> | <input type="checkbox"/> | | |

Reached end of the list
No errors found

OK

Good file system metadata

Log image 0

► MBR ► Volume0 (Microsoft FAT32) 3.73 GB ► Root ► PHOTOS

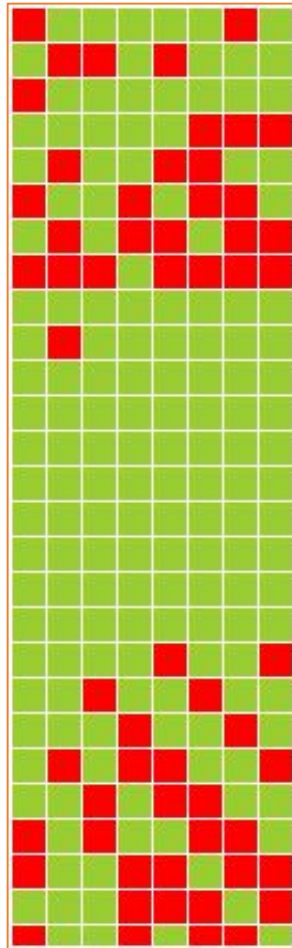
| | Name | Ext | Size | Last n |
|---|----------|-----|---------|--------|
| ► | .. | | | |
| ► | P1050430 | JPG | 1.95 MB | 02/27/ |
| ► | P1050431 | JPG | 1.94 MB | 02/27/ |
| ► | P1050432 | JPG | 1.93 MB | 02/27/ |
| ► | P1050433 | JPG | 1.99 MB | 02/27/ |
| ► | P1050434 | JPG | 1.77 MB | 02/27/ |
| ► | P1050436 | JPG | 1.80 MB | 02/27/ |
| ► | P1050437 | JPG | 1.55 MB | 02/27/ |
| ► | P1050438 | JPG | 1.53 MB | 02/27/ |
| ► | P1050439 | JPG | 1.36 MB | 02/27/ |
| ► | P1050448 | JPG | 2.41 MB | 03/07/ |
| ► | P1050449 | JPG | 1.77 MB | 03/07/ |
| ► | P1050450 | JPG | 1.99 MB | 03/07/ |
| ► | P1050451 | JPG | 2.36 MB | 03/07/ |
| ► | P1050452 | JPG | 2.22 MB | 03/07/ |
| ► | P1050453 | JPG | 2.35 MB | 03/07/ |
| ► | P1050454 | JPG | 2.35 MB | 03/07/ |
| ► | P1050455 | JPG | 2.34 MB | 03/07/ |
| ► | P1050456 | JPG | 2.36 MB | 03/07/ |
| ► | P1050457 | JPG | 2.26 MB | 03/07/ |
| ► | P1050458 | JPG | 2.22 MB | 03/07/ |
| ► | P1050459 | JPG | 2.10 MB | 03/07/ |
| ► | P1050461 | JPG | 1.87 MB | 03/07/ |
| ► | P1050463 | JPG | 1.87 MB | 03/07/ |
| ► | P1050464 | JPG | 1.90 MB | 03/07/ |
| ► | P1050465 | JPG | 1.95 MB | 03/07/ |
| ► | P1050466 | JPG | 2.07 MB | 03/07/ |

Real case

NAND memory device



ECC map



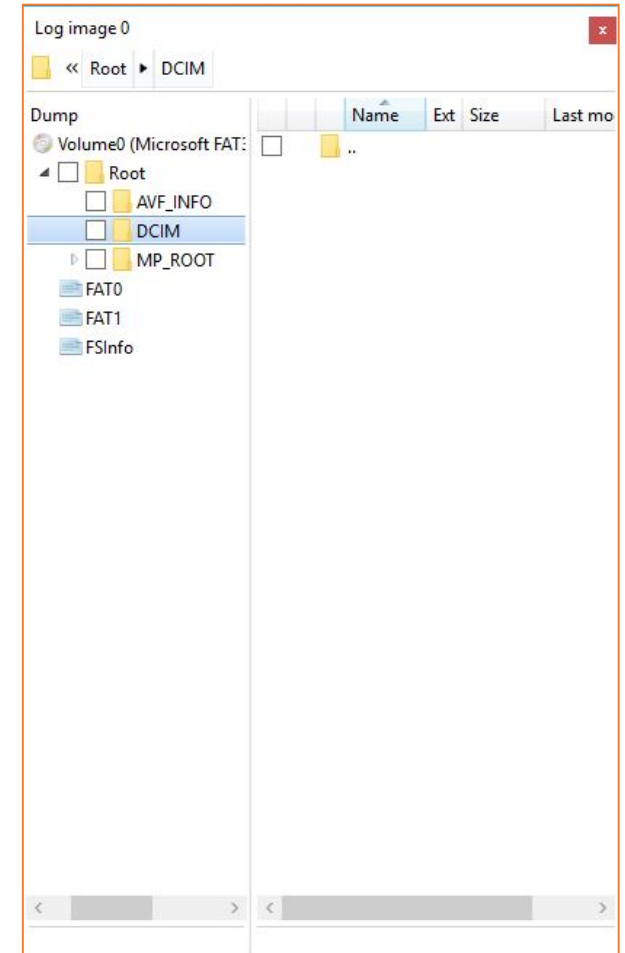
Lost blocks

| Markers table 0 | | | | | | | | | |
|-------------------------------------|------|------|--------|------------|--------------------------|--------------------------|--|--------------|----|
| Block markers | | | | | | | | Page markers | |
| Use | Bank | LBN | Header | Address | LB | RB | | LPN | Ac |
| <input checked="" type="checkbox"/> | 00 | 1003 | FF | 010A4F0000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000000 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1004 | FF | 00A3368000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000001 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1005 | FF | 010C278000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000002 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1006 | FF | 0107688000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000003 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1007 | FF | 010A928000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000004 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1008 | FF | 010A2D4000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000005 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1009 | FF | 010AF7C000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000006 | 00 |
| <input checked="" type="checkbox"/> | 00 | 100A | FF | 010BC24000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000007 | 00 |
| <input checked="" type="checkbox"/> | 00 | 100B | FF | 010854C000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000008 | 00 |
| <input checked="" type="checkbox"/> | 00 | 100C | FF | 010962C000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000009 | 00 |
| <input checked="" type="checkbox"/> | 00 | 100D | FF | 010C6B0000 | <input type="checkbox"/> | <input type="checkbox"/> | | 0000000A | 00 |
| <input checked="" type="checkbox"/> | 00 | 100E | FF | 010BA08000 | <input type="checkbox"/> | <input type="checkbox"/> | | 0000000B | 00 |
| <input checked="" type="checkbox"/> | 00 | 100F | FF | 01054C8000 | <input type="checkbox"/> | <input type="checkbox"/> | | 0000000C | 00 |
| <input checked="" type="checkbox"/> | 00 | 1010 | FF | 0106E18000 | <input type="checkbox"/> | <input type="checkbox"/> | | 0000000D | 00 |
| <input checked="" type="checkbox"/> | 00 | 1011 | FF | 0109A64000 | <input type="checkbox"/> | <input type="checkbox"/> | | 0000000E | 00 |
| <input checked="" type="checkbox"/> | 00 | 1012 | FF | 010DBC8000 | <input type="checkbox"/> | <input type="checkbox"/> | | 0000000F | 00 |
| <input checked="" type="checkbox"/> | 00 | 1013 | FF | 010B5D0000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000010 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1014 | FF | 0108FD8000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000011 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1015 | FF | 010A0B8000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000012 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1016 | FF | 0107CDC000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000013 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1017 | FF | 010C05C000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000014 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1018 | FF | 01056E4000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000015 | 00 |
| <input checked="" type="checkbox"/> | 00 | 1019 | FF | 010D358000 | <input type="checkbox"/> | <input type="checkbox"/> | | 00000016 | 00 |
| <input checked="" type="checkbox"/> | 00 | 101A | FF | 010D13C000 | <input type="checkbox"/> | <input type="checkbox"/> | | | |

Position 0x2 from 0x7FF

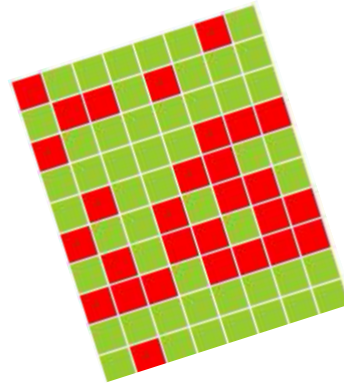
Position 0x0 from

Corrupted file system metadata



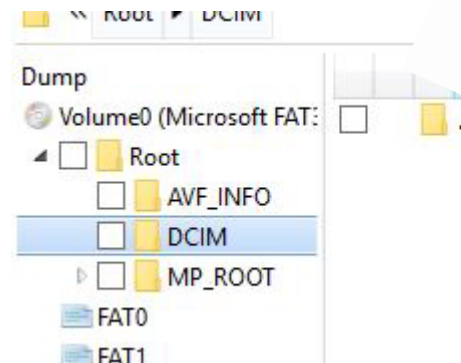
Typical problems when file carving should be used

- Bit errors
- Lost logical blocks
- Corrupted file system metadata
- Deleted files
- Data recovery from eMMC NAND



Markers table 0

| Use | Bank | LBN | Block markers | | | |
|-------------------------------------|------|------|---------------|------------|--------------------------|--------------------------|
| | | | Header | Address | LB | RB |
| <input checked="" type="checkbox"/> | 00 | 1003 | FF | 010A4F0000 | <input type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 00 | 1004 | FF | 00A3368000 | <input type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | 00 | 1005 | FF | 010C278000 | <input type="checkbox"/> | <input type="checkbox"/> |



Classic carving approach

The file header is the standard combination of several bytes at a standard offset at the start of the file.

The file footer is the standard combination of bytes at a standard offset at the end of the file.

0xFF D8 – JPEG header

0xFF D9 – JPEG footer

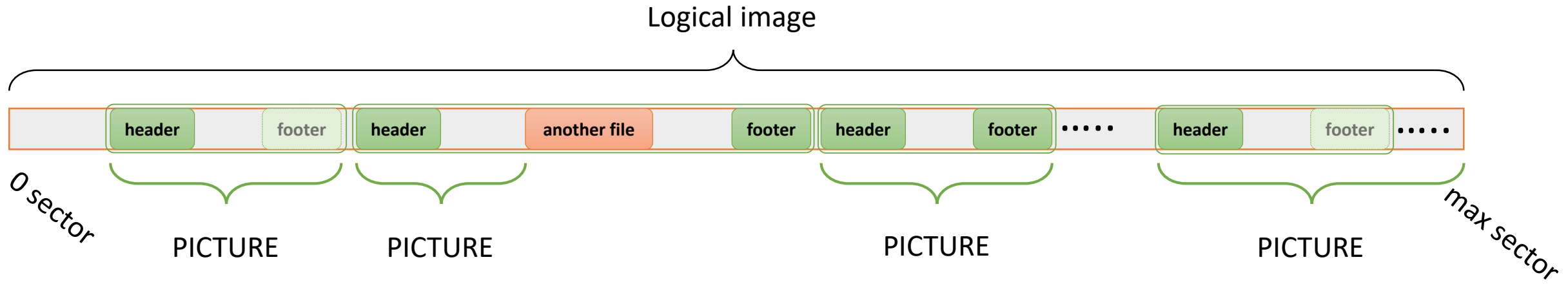
Offsets 0

| | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F | |
|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|------------------|
| 0000000000 | FF | D8 | FF | E1 | 3B | 94 | 45 | 78 | 69 | 66 | 00 | 00 | 49 | 49 | 2A | 00 | яЩяб;"Exif..II*. |
| 0000000010 | 00 | 00 | 00 | 00 | 0B | 00 | 0F | 01 | 02 | 00 | 06 | 00 | 00 | 00 | 92 | 00 |'. |
| 0000000020 | 00 | 00 | 10 | 01 | 02 | 00 | 0F | 00 | 00 | 00 | 98 | 00 | 00 | 00 | 12 | 01 |□..... |
| 0000000030 | 03 | 00 | 01 | 00 | 00 | 00 | 06 | 00 | 00 | 00 | 1A | 01 | 05 | 00 | 01 | 00 | |
| 0000000040 | 00 | 00 | B8 | 00 | 00 | 00 | 1B | 01 | 05 | 00 | 01 | 00 | 00 | 00 | C0 | 00 | ..ë.....A. |
| 0000000050 | 00 | 00 | 28 | 01 | 03 | 00 | 01 | 00 | 00 | 00 | 02 | 00 | 00 | 00 | 32 | 01 | ..(.....2. |
| 0000000060 | 02 | 00 | 14 | 00 | 00 | 00 | C8 | 00 | 00 | 00 | 3B | 01 | 02 | 00 | 01 | 00 |И...;..... |
| 0000000070 | 00 | 00 | 00 | 00 | 00 | 00 | 13 | 02 | 03 | 00 | 01 | 00 | 00 | 00 | 02 | 00 | |
| 0000000080 | 00 | 00 | 98 | 82 | 02 | 00 | 01 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 69 | 87 | ..□,.....i+ |
| 0000000090 | 04 | 00 | 01 | 00 | 00 | 00 | 5C | 01 | 00 | 00 | C2 | 21 | 00 | 00 | 43 | 61 |\...B!..Ca |
| 00000000A0 | 6F | 6F | 6E | 00 | 43 | 61 | 6E | 6F | 6F | 20 | 45 | 4F | 53 | 20 | 2C | 2C | non.Canon EOS |
| 00000000B0 | | | | | | | | | | | | | | | | | 0D..... |

| | | | | | | | | | | | | | | | | | |
|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-------------------|
| 0000292C20 | 8D | 22 | D5 | | | 4 | 01 | C6 | 4 | | | 4C | EE | 41 | | | 260,0A |
| 0000292C30 | AE | 01 | 21 | 79 | CF | 35 | 76 | 1C | 9D | C4 | 47 | F2 | F1 | 93 | 93 | E9 | В.....,eE\$.@- |
| 0000292C40 | 52 | 2C | BF | 29 | C1 | 23 | 27 | A5 | 3B | 12 | D9 | 5E | 6F | 98 | 61 | 7A | ©.!yП5v.кДGтс""й |
| 0000292C50 | 8E | A6 | A2 | C1 | 24 | 7A | 7A | 55 | A3 | 19 | 3B | 92 | C2 | 80 | B9 | 0D | R,i)B#'Г;.Щ^o□az |
| 0000292C60 | F7 | 7D | 6A | C3 | 46 | AA | 3E | 42 | 7F | 94 | 98 | 24 | 42 | CE | 00 | 03 | Н;ЎБ\$zzUJ.;'ВЪМ. |
| 0000292C70 | D2 | 98 | C3 | 3C | 8E | D5 | 28 | 4 | FF | D9 | 00 | 00 | 00 | 00 | 00 | 00 | ч}jГГЕ>В~"□\$BO.. |
| 0000292C80 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | Т□Г<ЪХ(ЛяЩ..... |
| 0000292C90 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 0000292CA0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 0000292CB0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 0000292CC0 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | 00 | |

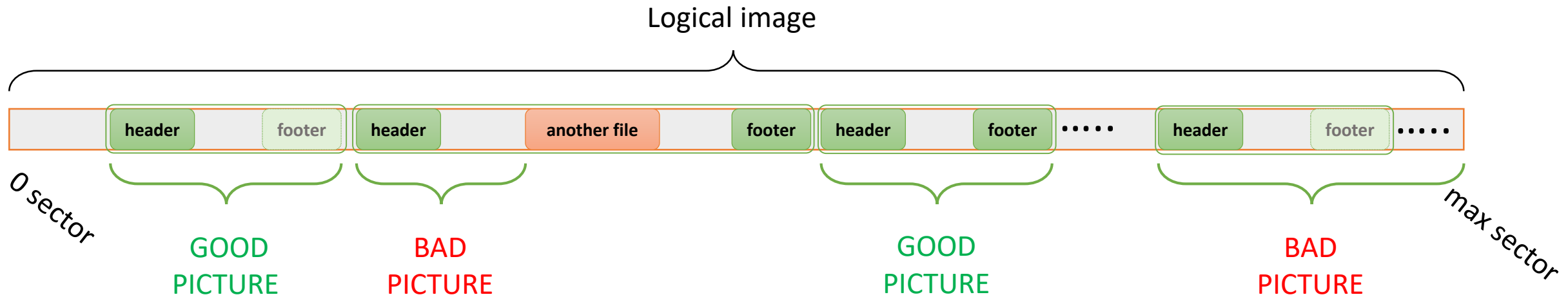
Address: 47449 Selected: 0

Classic carving approach



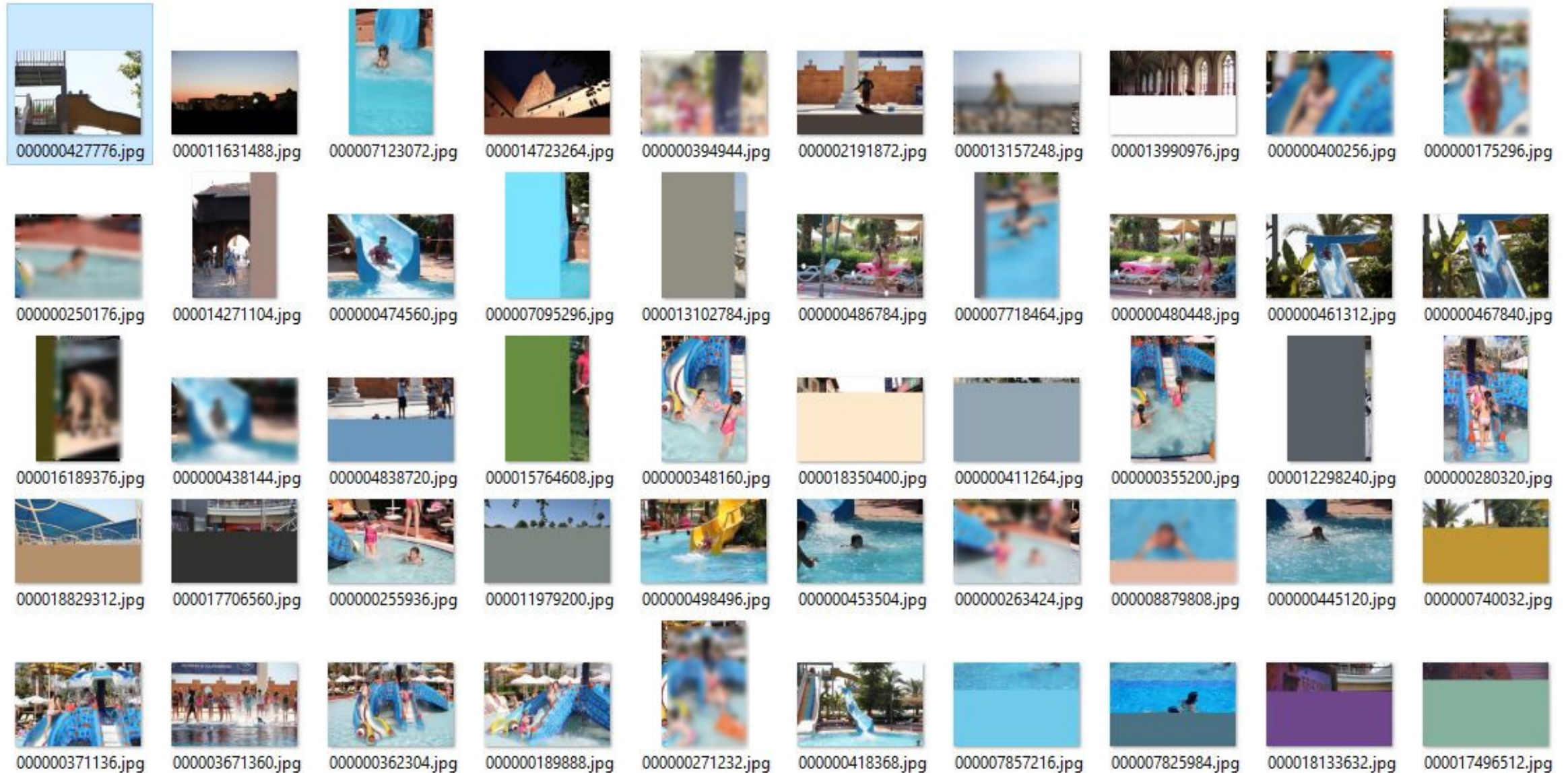
Searching for headers and footers is the classic carving approach. It assumes that the data between the header and footer or the header and next header is one file.

Classic carving approach



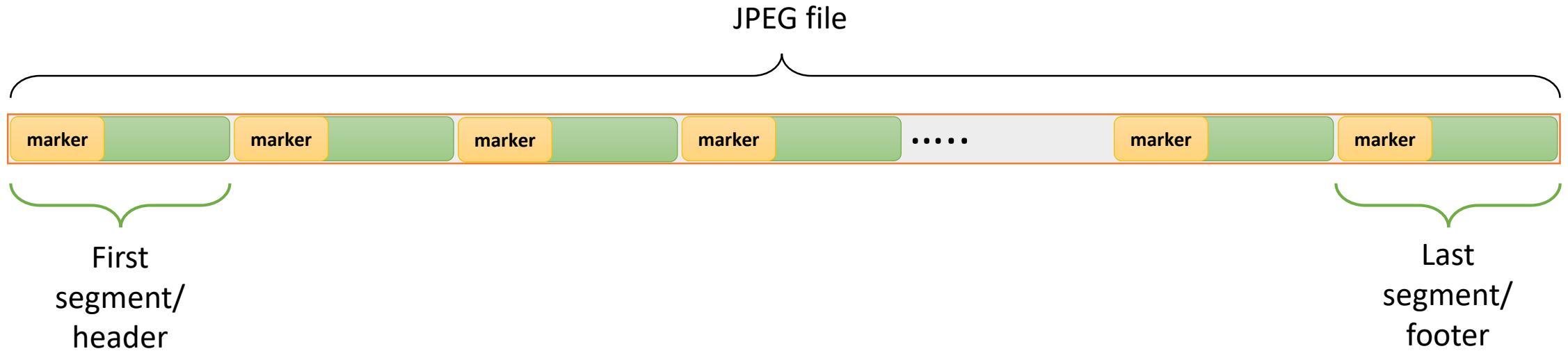
This approach may find many false positive results in the case of file fragmentation, lost blocks, or data corruption since file integrity is not checked.

Results of classic carving approach



The new VNR carver checks file integrity and can separate good files from bad ones.

JPEG carving



A JPEG image consists of a sequence of *segments*, each beginning with a *marker*.

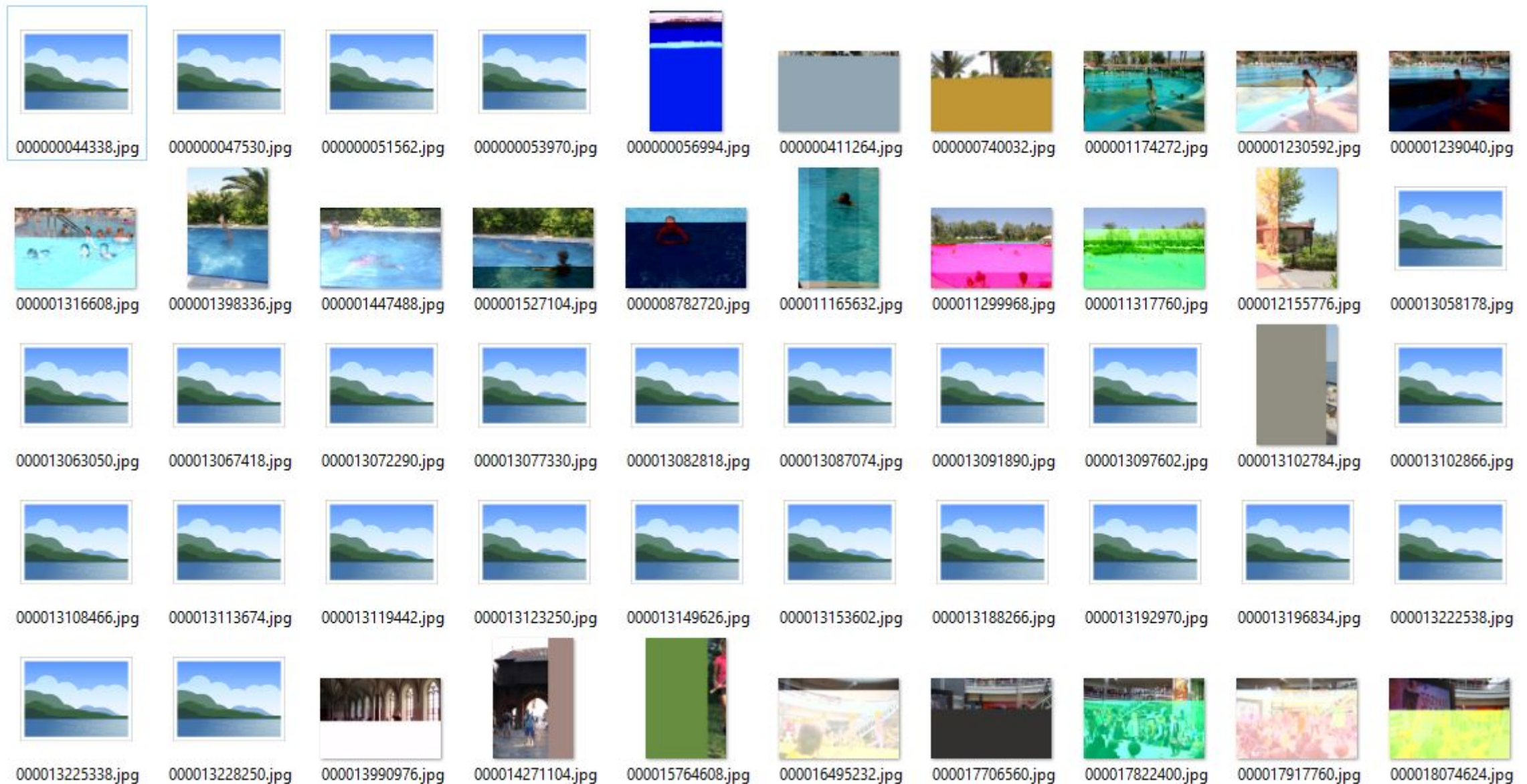
VNR carver checks the order and structure of the segments, and detects if the file is good or damaged.

Error types

Moreover, VNR carver rates the level of file damage and group bad pictures into three categories:

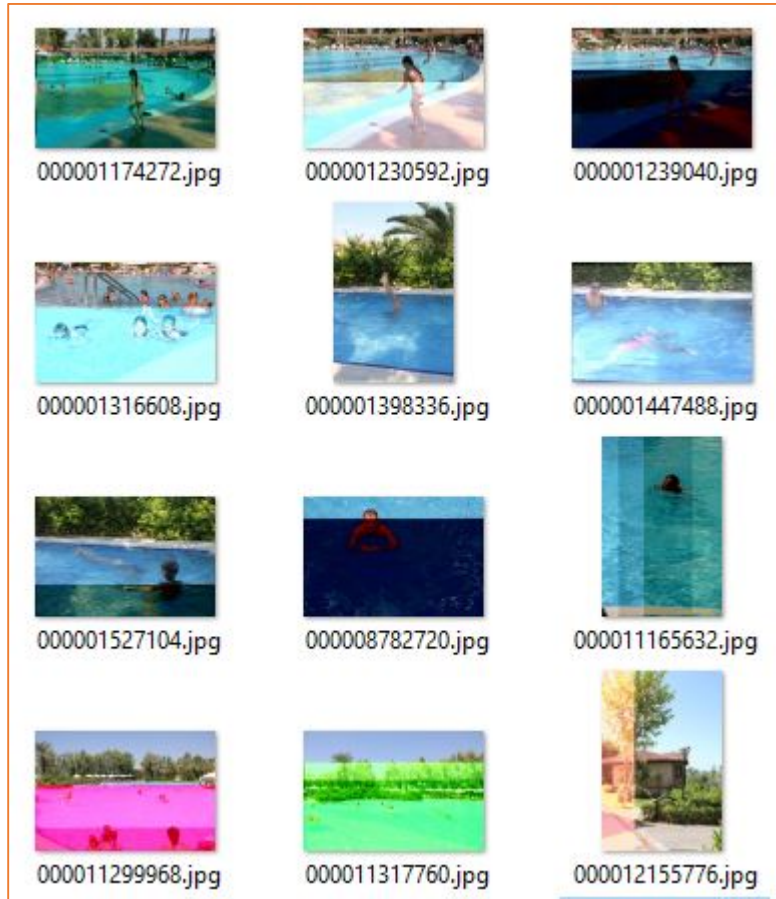
- Critical damage
- Medium damage
 - Bit error

Bad pictures without grouping by level of damage

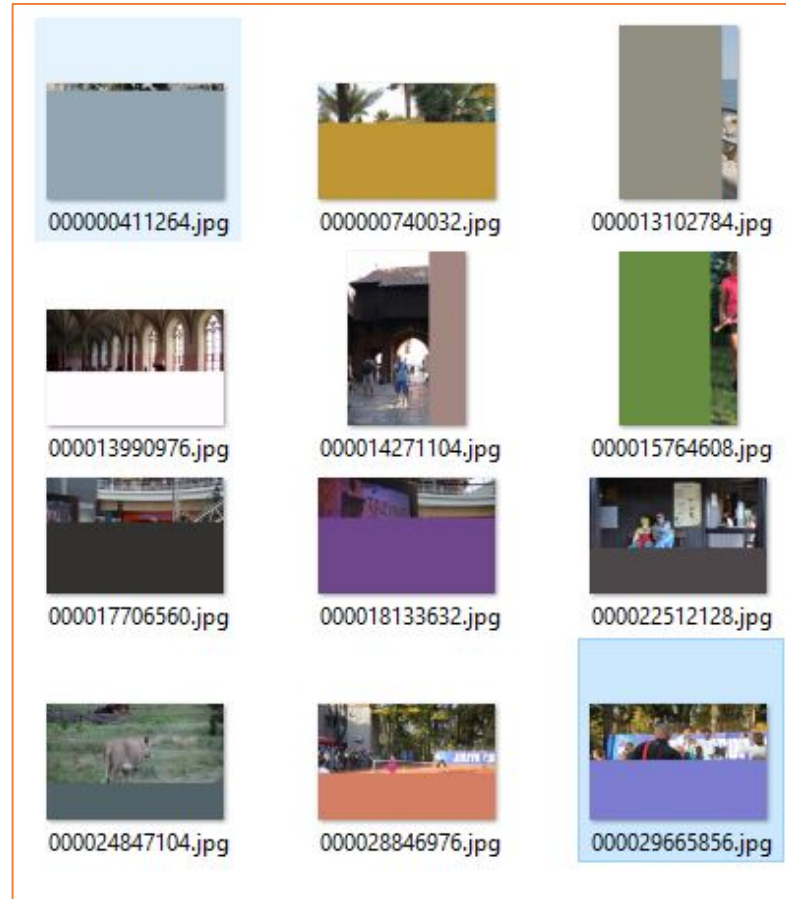


Bad pictures recovered by VNR carver

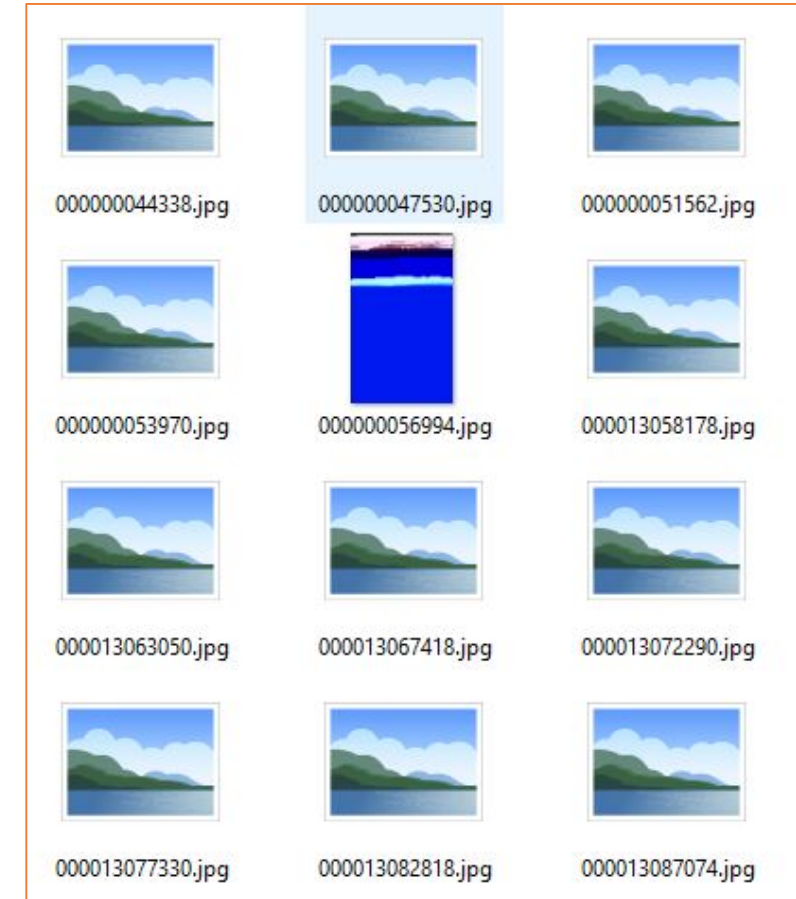
Bit error



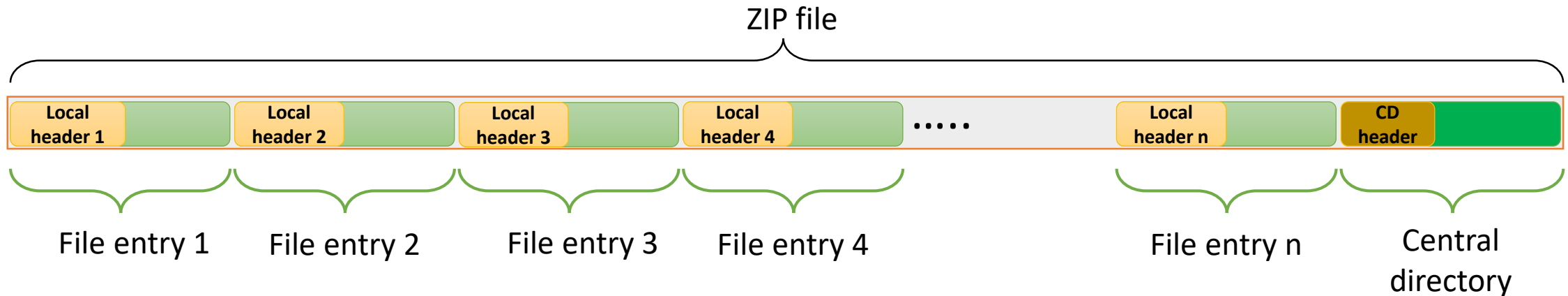
Medium damage



Critical damage



ZIP carving and file extraction



ZIP files are archives that store multiple files. A *directory* is placed at the end of a ZIP file. This identifies what files are in the ZIP and identifies where in the ZIP that file is located.

VNR carver checks the integrity of the whole ZIP in general and the internal integrity of each file in particular. This allows it to detect AND recover partly damaged archives which contains damaged files or archives with a damaged *central directory*.

As a result VNR shows GOOD, BAD, and PARTLY DAMAGED ZIP files.

Types of recovered ZIP files

GOOD file – all files inside the ZIP are good and have the correct CRC, The central directory is found and has a good structure, the Footer of the Central directory is found.

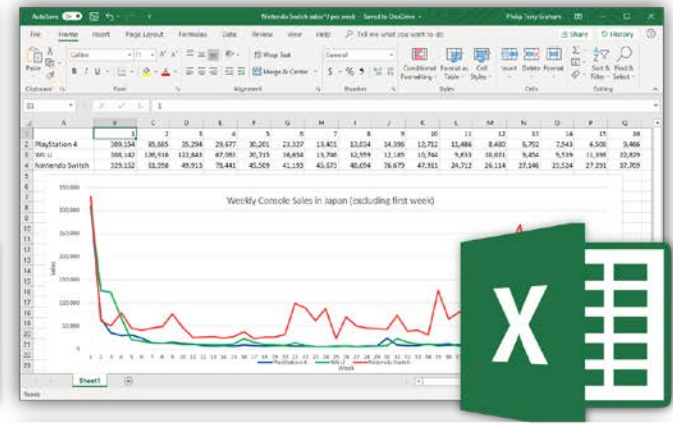
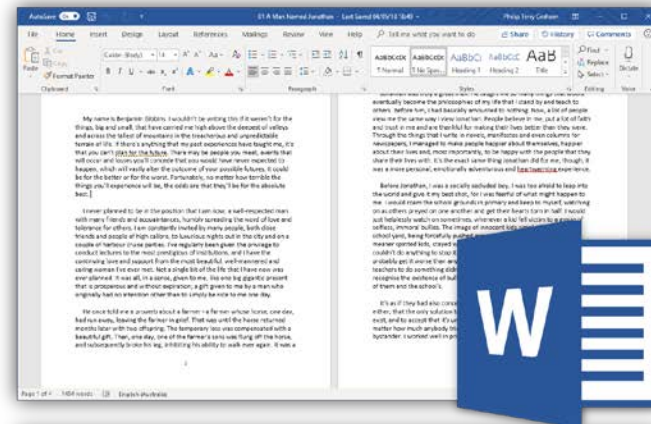
PARTLY DAMAGED file – at least one file is good and has the correct CRC, The Central directory is found and has a good structure, the Footer of the Central directory is found.

BAD file – the Local header is damaged/ ALL files inside the ZIP are damaged/ the Central directory is not found or is damaged.

Office files carving

VNR carver recovers WORD documents, SPREADSHEETS, and PRESENTATIONS made in modern Office applications. Supported formats are:

- .docx
- .xlsx
- .pptx
- .odt
- .ods
- .odp



Types of recovered office files

Since modern office applications use a ZIP-compressed XML-based file format, one office file is basically a ZIP archive with XML files inside. Then, it's possible to separate recovered results into three groups, the same as for ZIP files.

GOOD file – all XML files inside the office file are good and have a correct CRC, the Central directory is found and has a good structure, the Footer of the Central directory is found.

PARTLY DAMAGED file – at least one XML file is unpackable and has a good CRC, the Central directory is found and has a good structure, the Footer of the Central directory is found.

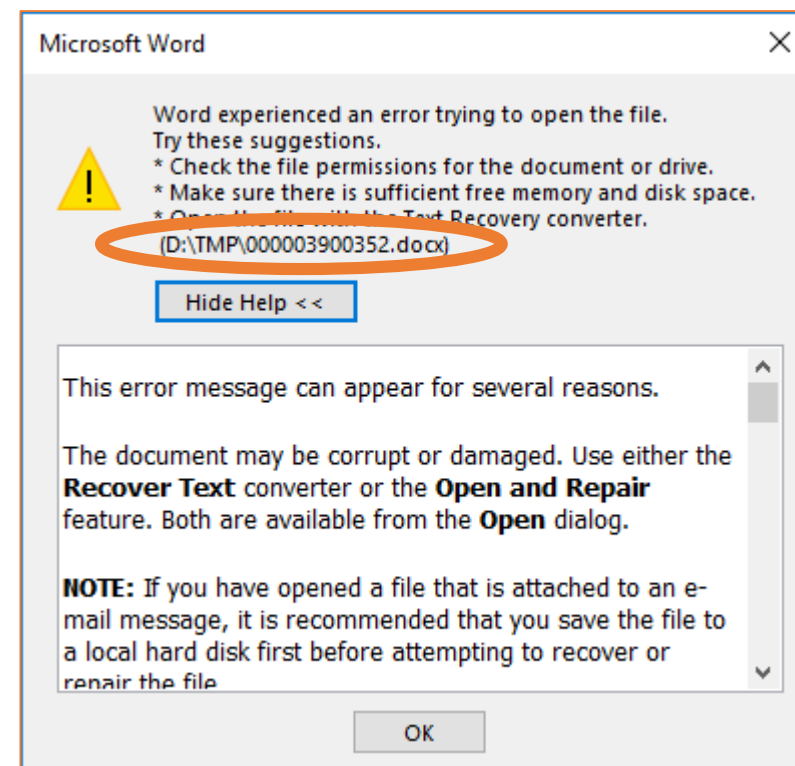
BAD file – the Local header is damaged/ the Central directory is not found or is damaged.

Partly damaged .docx file

| File carver | | | | | | | |
|-------------|-------------------|-----------|-----------|----------------|-------|--------------------------------|--------|
| Block | Name | Extension | Size | Status | Error | Name | Size |
| 3582976 | 000003582976.docx | docx | 877,001 | Partly Damaged | | [Content_Types].xml | 2,438 |
| 3022208 | 000003022208.docx | docx | 877,414 | Partly Damaged | | _rels/.rels | 590 |
| 2982144 | 000002982144.docx | docx | 876,759 | Partly Damaged | | word/_rels/document.xml.rels | 2,212 |
| 3049600 | 000003049600.docx | docx | 876,605 | Partly Damaged | | word/document.xml | 41,821 |
| 2580576 | 000002580576.docx | docx | 974,399 | Partly Damaged | | word/_rels/footer1.xml.rels | 290 |
| 4887840 | 000004887840.docx | docx | 875,911 | Partly Damaged | | word/footer2.xml | 6,323 |
| 3055872 | 000003055872.docx | docx | 152,008 | Partly Damaged | | word/footer1.xml | 6,113 |
| 2606112 | 000002606112.docx | docx | 972,572 | Partly Damaged | | word/endnotes.xml | 1,606 |
| 2614944 | 000002614944.docx | docx | 861,371 | Partly Damaged | | word/footnotes.xml | 1,612 |
| 2970496 | 000002970496.docx | docx | 876,728 | Partly Damaged | | word/_rels/header1.xml.rels | 290 |
| 2968768 | 000002968768.docx | docx | 877,725 | Partly Damaged | | word/_rels/footer2.xml.rels | 289 |
| 3047872 | 000003047872.docx | docx | 874,446 | Partly Damaged | | word/header1.xml | 5,941 |
| 3868864 | 000003868864.docx | docx | 878,057 | Partly Damaged | | word/media/image3.jpg | 40,167 |
| 4869024 | 000004869024.docx | docx | 875,162 | Partly Damaged | | word/theme/theme1.xml | 7,021 |
| 4855200 | 000004855200.docx | docx | 876,759 | Partly Damaged | | word/media/image1.jpeg | 30,409 |
| 3900352 | 000003900352.docx | docx | 151,972 | Partly Damaged | | word/media/image2.jpeg | 49,562 |
| 3023936 | 000003023936.docx | docx | 877,052 | Partly Damaged | | word/settings.xml | 8,814 |
| 3019456 | 000003019456.docx | docx | 1,400,598 | Partly Damaged | | word/styles.xml | 24,047 |
| 4870752 | 000004870752.docx | docx | 875,168 | Partly Damaged | | customXml/itemProps1.xml | 341 |
| 4850016 | 000004850016.docx | docx | 876,850 | Partly Damaged | | customXml/_rels/item1.xml.rels | 296 |
| 3061568 | 000003061568.docx | docx | 875,403 | Partly Damaged | | customXml/item1.xml | 218 |
| 3027392 | 000003027392.docx | docx | 877,184 | Partly Damaged | | docProps/app.xml | 1,003 |
| 3015808 | 000003015808.docx | docx | 875,688 | Partly Damaged | | word/stylesWithEffects.xml | 24,800 |
| 3029120 | 000003029120.docx | docx | 875,702 | Partly Damaged | | word/webSettings.xml | 2,074 |
| 3002432 | 000003002432.docx | docx | 878,814 | Partly Damaged | | word/fontTable.xml | 2,531 |
| 3000704 | 000003000704.docx | docx | 877,659 | Partly Damaged | | docProps/core.xml | 697 |
| 3581248 | 000003581248.docx | docx | 877,037 | Partly Damaged | | word/numbering.xml | 22,431 |

Checked files: 7135, Good files: 4180, Bad files: 2846

Save all files Save good files Save bad files Save partly damaged files Search Cancel



Partly damaged .docx file

| File carver | | | | | | | |
|-------------|-------------------|-----------|-----------|----------------|-------|--------------------------------|--------|
| Block | Name | Extension | Size | Status | Error | Name | Size |
| 3582976 | 000003582976.docx | docx | 877,001 | Partly Damaged | | [Content_Types].xml | 2,438 |
| 3022208 | 000003022208.docx | docx | 877,414 | Partly Damaged | | _rels/.rels | 590 |
| 2982144 | 000002982144.docx | docx | 876,759 | Partly Damaged | | word/_rels/document.xml.rels | 2,212 |
| 3049600 | 000003049600.docx | docx | 876,605 | Partly Damaged | | word/document.xml | 41,821 |
| 2580576 | 000002580576.docx | docx | 974,399 | Partly Damaged | | word/_rels/footer1.xml.rels | 290 |
| 4887840 | 000004887840.docx | docx | 875,911 | Partly Damaged | | word/footer2.xml | 6,323 |
| 3055872 | 000003055872.docx | docx | 152,008 | Partly Damaged | | word/footer1.xml | 6,113 |
| 2606112 | 000002606112.docx | docx | 972,572 | Partly Damaged | | word/endnotes.xml | 1,606 |
| 2614944 | 000002614944.docx | docx | 861,371 | Partly Damaged | | word/footnotes.xml | 1,612 |
| 2970496 | 000002970496.docx | docx | 876,728 | Partly Damaged | | word/_rels/header1.xml.rels | 290 |
| 2968768 | 000002968768.docx | docx | 877,725 | Partly Damaged | | word/_rels/footer2.xml.rels | 289 |
| 3047872 | 000003047872.docx | docx | 874,446 | Partly Damaged | | word/header1.xml | 5,941 |
| 3868864 | 000003868864.docx | docx | 878,057 | Partly Damaged | | word/media/image3.jpeg | 40,167 |
| 4869024 | 000004869024.docx | docx | 875,162 | Partly Damaged | | word/theme/theme1.xml | 7,021 |
| 4855200 | 000004855200.docx | docx | 876,759 | Partly Damaged | | word/media/image1.jpeg | 30,409 |
| 3900352 | 000003900352.docx | docx | 151,972 | Partly Damaged | | word/media/image2.jpeg | 49,562 |
| 3023936 | 000003023936.docx | docx | 877,632 | Partly Damaged | | word/settings.xml | 8,814 |
| 3019456 | 000003019456.docx | docx | 1,400,598 | Partly Damaged | | word/styles.xml | 24,047 |
| 4870752 | 000004870752.docx | docx | 875,168 | Partly Damaged | | customXml/itemProps1.xml | 341 |
| 4850016 | 000004850016.docx | docx | 876,850 | Partly Damaged | | customXml/_rels/item1.xml.rels | 296 |
| 3061568 | 000003061568.docx | docx | 875,403 | Partly Damaged | | customXml/item1.xml | 218 |
| 3027392 | 000003027392.docx | docx | 877,184 | Partly Damaged | | docProps/app.xml | 1,003 |
| 3015808 | 000003015808.docx | docx | 875,688 | Partly Damaged | | word/stylesWithEffects.xml | 24,800 |
| 3029120 | 000003029120.docx | docx | 875,702 | Partly Damaged | | word/webSettings.xml | 2,074 |
| 3002432 | 000003002432.docx | docx | 878,814 | Partly Damaged | | word/fontTable.xml | 2,531 |
| 3000704 | 000003000704.docx | docx | 877,659 | Partly Damaged | | docProps/core.xml | 697 |
| 3581248 | 000003581248.docx | docx | 877,037 | Partly Damaged | | word/numbering.xml | 22,431 |

Checked files: 7135, Good files: 4180, Bad files: 2846

Save all files Save good files Save bad files Save partly damaged files Search Cancel

Metadata information is usually stored in the folder **docProps**. Two or more XML files are stored inside that folder: **app.xml** that stores metadata information extracted from the Word application itself and **core.xml** that stores metadata from the document itself, such as *the author name, last time it was printed, etc.*

Word folder contains the actual content of the document. An XML file called **document.xml** is the main document, containing most of the content of the document itself.

Partly damaged .docx file

CORE.XML

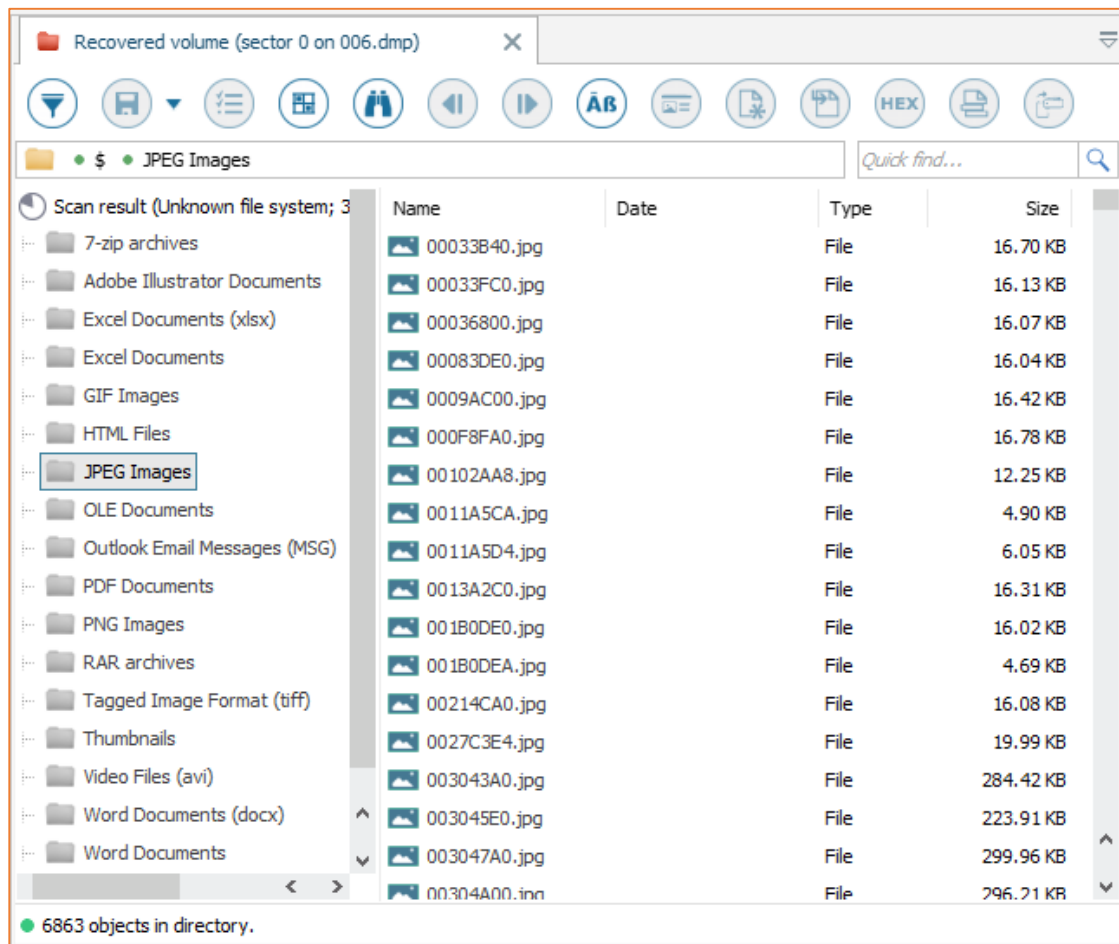
```
<?xml version="1.0" encoding="UTF-8" standalone="true"?>
- <cp:coreProperties xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:dc="http://purl.org/dc/terms/" xmlns:dcterms="http://purl.org/dc/terms/"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:cp="http://schemas.openxmlformats.org/package/2006/metadata/core-properties">
  <dc:creator>Michał</dc:creator>
  <cp:lastModifiedBy>Robert Salamonik</cp:lastModifiedBy>
  <cp:revision>6</cp:revision>
  <cp:lastPrinted>2013-05-07T15:24:00Z</cp:lastPrinted>
  <dcterms:created xsi:type="dcterms:W3CDTF">2013-05-07T15:03:00Z</dcterms:created>
  <dcterms:modified xsi:type="dcterms:W3CDTF">2013-05-07T15:29:00Z</dcterms:modified>
</cp:coreProperties>
```

DOCUMENT.XML

```
- <w:rPr>
  <w:rFonts w:cs="Arial" w:hAnsi="Arial" w:ascii="Arial"/>
  <w:sz w:val="20"/>
  <w:szCs w:val="20"/>
</w:rPr>
</w:pPr>
- <w:r w:rsidRPr="00443D25">
  - <w:rPr>
    <w:rFonts w:cs="Arial" w:hAnsi="Arial" w:ascii="Arial"/>
    <w:sz w:val="20"/>
    <w:szCs w:val="20"/>
  </w:rPr>
  <w:t xml:space="preserve">Wyjaśniamy, że </w:t>
</w:r>
- <w:r w:rsidR="002B49F7">
  - <w:rPr>
    <w:rFonts w:cs="Arial" w:hAnsi="Arial" w:ascii="Arial"/>
    <w:sz w:val="20"/>
    <w:szCs w:val="20"/>
  </w:rPr>
  <w:t xml:space="preserve">przyznane odszkodowanie decyzją z dnia </w:t>
</w:r>
- <w:r w:rsidR="004F3492">
  - <w:rPr>
    <w:rFonts w:cs="Arial" w:hAnsi="Arial" w:ascii="Arial"/>
    <w:sz w:val="20"/>
    <w:szCs w:val="20"/>
  </w:rPr>
```


Comparison of results

Software #1



| FILE extension | Total amount |
|----------------|--------------|
| ZIP | 23 |
| DOCX | 276 |
| XLSX | 18 |
| JPEG | 6863 |

Comparison of results

Software #2

The screenshot shows a file recovery software interface. At the top, there's a toolbar with various icons and a file name '0 - 006.dmp'. Below the toolbar, the 'Categories' pane on the left lists file types: Archives (3), Documents (295), and Images (6,789). The 'Files' pane below it shows a detailed list of files, including their LBA, Type, Size (bytes), and Checked size (bytes). The 'Parameters' pane on the right shows search settings: Initial LBA (0), Final LBA (17,465,341), and Step (1). The 'Filter for files' section has checkboxes for 'Good files', 'Corrupted files', and 'Unchecked files', with 'Group by types' selected. The 'Apply' button is visible. At the bottom, a status bar shows 'Quantity: 6,789', 'Total size: 5,205,626 MB', 'Raw recovery - complete', and 'LBA = 17,455,454'.

| EXT | Type | Quantity | GREP |
|----------------------------|------|------------|------|
| Files: Archives | | 3 | |
| ZIP Archive | | 3 | |
| Files: Documents | | 295 | |
| MS Word Open XML Document | | 280 | |
| MS Excel Open XML Document | | 15 | |
| Files: Images | | 6 789 | |
| JPEG Image | | (46) 6 789 | ... |

| LBA | Type | Size (bytes) | Checked size (bytes) |
|------------|------------|--------------|----------------------|
| 15 177 792 | JPEG Image | 858 102 | 858 102 |
| 15 179 488 | JPEG Image | 881 388 | 881 388 |
| 15 181 216 | JPEG Image | 869 035 | 869 035 |
| 15 182 944 | JPEG Image | 835 584 | 65 536 |
| 15 184 576 | JPEG Image | 839 112 | 839 112 |
| 15 186 240 | JPEG Image | 545 359 | 545 359 |
| 15 187 808 | JPEG Image | 5 062 656 | 65 536 |
| 15 197 696 | JPEG Image | 451 776 | 451 776 |
| 15 199 264 | JPEG Image | 802 816 | 65 536 |
| 15 200 832 | JPEG Image | 851 968 | 65 536 |
| 15 202 496 | JPEG Image | 555 628 | 555 628 |
| 15 204 064 | JPEG Image | 802 816 | 65 536 |
| 15 205 632 | JPEG Image | 802 816 | 65 536 |
| 15 207 200 | JPEG Image | 802 816 | 65 077 |
| 15 208 768 | JPEG Image | 802 816 | 65 536 |
| 15 210 336 | JPEG Image | 802 816 | 65 536 |

| FILE extension | Total amount | Good | Bad |
|----------------|--------------|------|------|
| ZIP | 3 | 0 | 3 |
| DOCX | 280 | 162 | 118 |
| XLSX | 15 | 14 | 1 |
| JPEG | 6774 | 4077 | 2697 |

Comparison of results

Software #3

| Name | Recov | Path | Size, Bytes | Created |
|----------------------------|-------|--------------|-------------|---------|
| img_1281x1_06543.jpg | ● | Root/Grap... | 463,353 | |
| img_1281x1_06603.jpg | ● | Root/Grap... | 662,724 | |
| img_1281x1_06658.jpg | ● | Root/Grap... | 134,786 | |
| img_1281x1_06747.jpg | ● | Root/Grap... | 571,119 | |
| img_1281x1_06861.jpg | ● | Root/Grap... | 916,616 | |
| img_1536x2048x24_03642.jpg | ● | Root/Grap... | 625,096 | |
| img_1536x2048x24_06702.jpg | ● | Root/Grap... | 418,182 | |
| img_1600x1200x24_01677.jpg | ● | Root/Grap... | 735,057 | |
| img_160x120x24_00341.jpg | ● | Root/Grap... | 6,380 | |
| img_160x120x24_00387.jpg | ● | Root/Grap... | 4,493 | |
| img_160x120x24_00391.jpg | ● | Root/Grap... | 5,276 | |
| img_1653x1240x24_07025.jpg | ● | Root/Grap... | 527,268 | |
| img_1653x1240x24_07026.jpg | ● | Root/Grap... | 157,842 | |
| img_1653x1240x24_07027.jpg | ● | Root/Grap... | 200,299 | |
| img_1653x1240x24_07028.jpg | ● | Root/Grap... | 175,398 | |
| img_1653x1240x24_07029.jpg | ● | Root/Grap... | 155,415 | |
| img_1653x1240x24_07030.jpg | ● | Root/Grap... | 154,958 | |
| img_1653x1240x24_07031.jpg | ● | Root/Grap... | 154,700 | |
| img_1653x1240x24_07032.jpg | ● | Root/Grap... | 199,836 | |
| img_1653x1240x24_07033.jpg | ● | Root/Grap... | 161,593 | |
| img_1653x1240x24_07034.jpg | ● | Root/Grap... | 118,926 | |


| FILE extension | Total amount | Good | Bad |
|----------------|--------------|------|------|
| ZIP | 126 | 15 | 111 |
| DOCX | 172 | 159 | 13 |
| XLSX | 17 | 17 | 0 |
| JPEG | 6775 | 5327 | 1448 |

Comparison of results

VNR carver

File carver

| Block | Name | Extension | Size | Status | Error |
|----------|------------------|-----------|---------|--------|---------------|
| 14631328 | 000014631328.jpg | jpg | 391,031 | Bad | Bit error |
| 14632896 | 000014632896.jpg | jpg | 903,537 | Good | |
| 14634688 | 000014634688.jpg | jpg | 412,087 | Bad | Bit error |
| 14636256 | 000014636256.jpg | jpg | 468,914 | Bad | Bit error |
| 14637824 | 000014637824.jpg | jpg | 416,149 | Bad | Medium damage |
| 14647584 | 000014647584.jpg | jpg | 472,756 | Bad | Medium damage |
| 14652128 | 000014652128.jpg | jpg | 123,658 | Good | |
| 14652384 | 000014652384.jpg | jpg | 129,063 | Good | |
| 14652640 | 000014652640.jpg | jpg | 137,030 | Good | |
| 14652928 | 000014652928.jpg | jpg | 81,339 | Good | |
| 14653088 | 000014653088.jpg | jpg | 70,606 | Good | |
| 14653248 | 000014653248.jpg | jpg | 82,243 | Good | |
| 14653440 | 000014653440.jpg | jpg | 73,977 | Good | |
| 14653600 | 000014653600.jpg | jpg | 93,017 | Good | |
| 14653792 | 000014653792.jpg | jpg | 127,569 | Good | |



Total files: 7135 | Good files: 4180, jpg(4096), zip(3), docx(66), xlsx(15), pptx(0), odt(0) | Bad files: 2955 | JPEG error: critical(112), medium(1085), bit(1509)

Save all files

Save good files

Save bad files

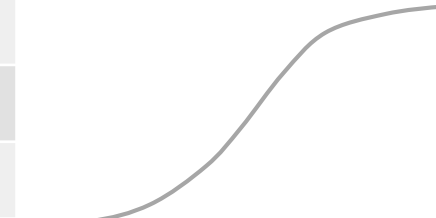
Save partly damaged files

Search

Cancel

| FILE extension | Total amount | Good | Bad |
|----------------|--------------|------|------|
| ZIP | 117 | 3 | 114 |
| DOCX | 172 | 66 | 106 |
| XLSX | 17 | 15 | 2 |
| JPEG | 6828 | 4096 | 2732 |

Comparison of results

| JPEG | | | | Bad pictures | | |
|------|-------|------|------|-------------------------------------------------------------------------------------|-----------|---------------|
| | Total | Good | Bad | | | |
| SW 1 | 6863 | X | X |  | BIT error | Medium damage |
| SW 2 | 6774 | 4077 | 2697 | | | |
| SW 3 | 6775 | 5327 | 1448 | | | |
| VNR | 6828 | 4096 | 2732 | | | |
| | | | | 1509 | 1085 | 138 |

| ZIP | | | | |
|------|-------|------|-----|------------|
| | Total | Good | Bad | Partly bad |
| SW 1 | 23 | X | X | X |
| SW 2 | 3 | 0 | 3 | X |
| SW 3 | 126 | 15 | 111 | X |
| VNR | 117 | 3 | 113 | 1 |

| DOCX | | | | |
|------|-------|------|-----|------------|
| | Total | Good | Bad | Partly bad |
| SW 1 | 276 | X | X | X |
| SW 2 | 280 | 162 | 118 | X |
| SW 3 | 172 | 159 | 13 | X |
| VNR | 172 | 66 | 0 | 106 |

| XLSX | | | | |
|------|-------|------|-----|------------|
| | Total | Good | Bad | Partly bad |
| SW 1 | 18 | X | X | X |
| SW 2 | 15 | 14 | 1 | X |
| SW 3 | 17 | 17 | 0 | X |
| VNR | 17 | 15 | 0 | 2 |