pdfSweep

an iText 7 add-on

pdfSweep: what it does and why you need it

Today, it is easy to distribute documents among large numbers of people with diverse needs. You can also grant or restrict access the content of these documents to keep information in the right hands. Both company policies and international regulations may require redaction of sensitive information before archiving or sharing documents with all users. Companies and organizations need tools to implement this redaction process in a flexible and automated way, with absolute guarantees regarding the elimination of the targeted elements. pdfSweep can help.

What is pdfSweep?

pdfSweep is an iText add-on that removes (redacts) sensitive information from a PDF (Portable Document Format) document. Confidentiality is assured, because the redacted information cannot be recovered. In a secure two-step process, pdfSweep deletes text and images at user-defined coordinates, or as defined by a regular expression. After having parsed the rendering information in the original PDF document, a new document is created without the redacted content.

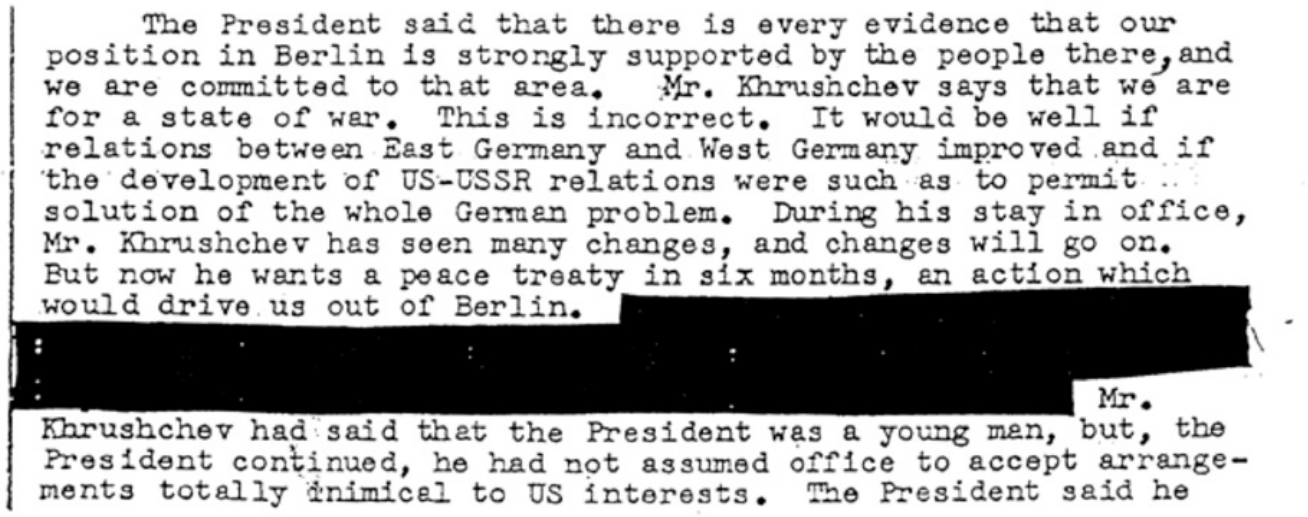
Why do we need redaction?

Redaction can be useful whenever the publisher or author of a document wishes to take out certain information. Common use cases include:

- Freedom of Information Act (USA) and similar legislation in other countries
- Governmental declassification procedures
- Proprietary information
- Trade secrets
- General Data Protection Regulation (Europe)
- All data that would impact the privacy of people
    - Social security numbers (USA)
    - National register identification numbers
    - Phone numbers
    - Bank account details
    - Names of people in a clinical trial

A short history of redaction

In the past, 'redaction' simply involved printing a document, blacking out the necessary information and making a photocopy of the document. That way, all information covered by dark ink simply does not get copied. This worked because paper is a simple WYSIWYG format. There is no hidden data, no metadata that needs to be erased.



The President said that there is every evidence that our position in Berlin is strongly supported by the people there, and we are committed to that area. Mr. Khrushchev says that we are for a state of war. This is incorrect. It would be well if relations between East Germany and West Germany improved and if the development of US-USSR relations were such as to permit solution of the whole German problem. During his stay in office, Mr. Khrushchev has seen many changes, and changes will go on. But now he wants a peace treaty in six months, an action which would drive us out of Berlin.

[redacted]

Mr. Khrushchev had said that the President was a young man, but, the President continued, he had not assumed office to accept arrangements totally inimical to US interests. The President said he

Figure 0: Example redacted document

In addition to the content as such, a PDF document essentially contains instructions for rendering the document in a viewer. Adding an instruction to draw a black rectangle does not erase text-rendering instructions pertaining to the information underneath the rectangle. This essentially means that covering up information is no longer sufficient, and actual removal/replacement of the content and related instructions is needed. Otherwise text-extraction (or simply copy/pasting the text from your viewer to a text editor) would yield the 'redacted' but still available data.

Challenges in redacting PDF documents

This is a (well-behaved) example of raw PDF content. It tells the viewer to render the text "appearance" and "Pilot".

```
[a, -28.7356, p, 27.2652, p, 27.2652, e, -27.2652, a, -28.7356, r, 64.6889, a, -28.7356,
n, 27.2652, c, -38.7594, e, 444] TJ
/R10 10.44 Tf
68.16 0.24 Td
[P, -18.7118, i, -9.35592, l, -9.35592, o, -17.2414, t, -9.35636] TJ
```

In general, redacting a PDF document is significantly harder than simply covering up the data that is to be redacted because:

- Text rendering instructions do not need to appear in logical (reading) order.
- Text rendering instructions do not always constitute complete words/chunks of text.
- Transformations can be applied (shift, scale, font transformation, etc).
- PDF documents can contain metadata, which should also be checked.
- PDF documents can contain scripts. Thus adding the possibility of dynamic content.

Similar problems occur with images:

- Images can be defined as a series of drawing operations.
- All instructions of a page have to be processed to determine where each shape intersects with the redaction area, in order to find a neat way to avoid drawing in that area.
- Images can be added to a PDF document under many formats.

How does pdfSweep work?

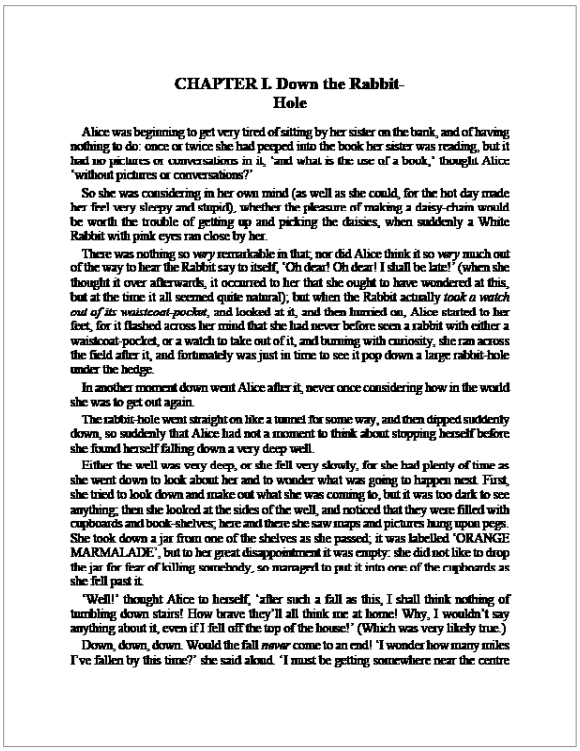
The basic pdfSweep workflow has just two easy steps:

- Select those parts of the document that must be redacted: either by specifying the coordinates, or by inputting a regular expression that fits your needs. We have already provided a substantial list of common regular expressions to do some of the heavy lifting for you, such as social security numbers, phone numbers, dates, etc.
- Pass the locations to pdfSweep, or invoke pdfAutoSweep with the pattern(s) of your choice.

This is a pdfAutoSweep example that redacts the words 'Alice' and 'White Rabbit' and 'Rabbit' (regardless of casing). It marks all occurrences of Alice with a pink rectangle, and all occurences of 'Rabbit' with a gray rectangle.

```
// Load the license to be able to use pdfSweep
LicenseKey.loadLicenseFile(licenceFile);

String input = "AliceInWonderLand.pdf";
String output = "AliceInWonderLandRedacted.pdf";

// define a composite strategy
CompositeCleanupStrategy strategy = new CompositeCleanupStrategy();
strategy.add(new RegexBasedCleanupStrategy("Alice").setRedactionColor(Color.PINK));
strategy.add(new RegexBasedCleanupStrategy("(White )*Rabbit").setRedactionColor(Color.
GRAY));

PdfWriter writer = new PdfWriter(output);
writer.setCompressionLevel(0);
PdfDocument pdf = new PdfDocument(new PdfReader(input), writer);

// sweep
PdfAutoSweep pdfAutoSweep = new PdfAutoSweep(strategy);
pdfAutoSweep.cleanUp(pdf);
```

This is the original document:



CHAPTER I. Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, 'and what is the use of a book,' thought Alice 'without pictures or conversations?'

So she was considering in her own mind (as well as she could, for the hot day made her feel very sleepy and stupid), whether the pleasure of making a daisy-chain would be worth the trouble of getting up and picking the daisies, when suddenly a White Rabbit with pink eyes ran close by her.

There was nothing so *very* remarkable in that; nor did Alice think it so *very* much out of the way to hear the Rabbit say to itself, 'Oh dear! Oh dear! I shall be late!' (when she thought it over afterwards, it occurred to her that she ought to have wondered at this, but at the time it all seemed quite natural); but when the Rabbit actually *took a watch out of its waistcoat-pocket*, and looked at it, and then hurried on, Alice started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it, and burning with curiosity, she ran across the field after it, and fortunately was just in time to see it pop down a large rabbit-hole under the hedge.

In another moment down went Alice after it, never once considering how in the world she was to get out again.

The rabbit-hole went straight on like a tunnel for some way, and then dipped suddenly down, so suddenly that Alice had not a moment to think about stopping herself before she found herself falling down a very deep well.

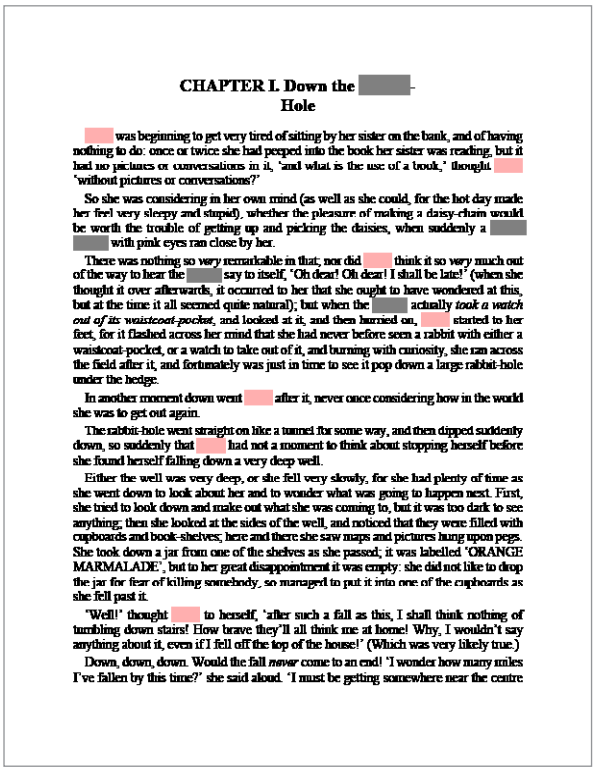
Either the well was very deep, or she fell very slowly, for she had plenty of time as she went down to look about her and to wonder what was going to happen next. First, she tried to look down and make out what she was coming to, but it was too dark to see anything; then she looked at the sides of the well, and noticed that they were filled with cupboards and book-shelves; here and there she saw maps and pictures hung upon pegs. She took down a jar from one of the shelves as she passed; it was labelled 'ORANGE MARMALADE', but to her great disappointment it was empty: she did not like to drop the jar for fear of killing somebody, so managed to put it into one of the cupboards as she fell past it.

'Well!' thought Alice to herself, 'after such a fall as this, I shall think nothing of tumbling down stairs! How brave they'll all think me at home! Why, I wouldn't say anything about it, even if I fell off the top of the house!' (Which was very likely true.)

Down, down, down. Would the fall *never* come to an end! 'I wonder how many miles I've fallen by this time?' she said aloud. 'I must be getting somewhere near the centre

Figure 1: pdfSweep original input document

And this is 'post redaction':



CHAPTER I. Down the [redacted]-Hole

[redacted] was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, 'and what is the use of a book,' thought [redacted] 'without pictures or conversations?'

So she was considering in her own mind (as well as she could, for the hot day made her feel very sleepy and stupid), whether the pleasure of making a daisy-chain would be worth the trouble of getting up and picking the daisies, when suddenly a [redacted] with pink eyes ran close by her.

There was nothing so *very* remarkable in that; nor did [redacted] think it so *very* much out of the way to hear the [redacted] say to itself, 'Oh dear! Oh dear! I shall be late!' (when she thought it over afterwards, it occurred to her that she ought to have wondered at this, but at the time it all seemed quite natural); but when the [redacted] actually *took a watch out of its waistcoat-pocket*, and looked at it, and then hurried on, [redacted] started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it, and burning with curiosity, she ran across the field after it, and fortunately was just in time to see it pop down a large rabbit-hole under the hedge.

In another moment down went [redacted] after it, never once considering how in the world she was to get out again.

The rabbit-hole went straight on like a tunnel for some way, and then dipped suddenly down, so suddenly that [redacted] had not a moment to think about stopping herself before she found herself falling down a very deep well.

Either the well was very deep, or she fell very slowly, for she had plenty of time as she went down to look about her and to wonder what was going to happen next. First, she tried to look down and make out what she was coming to, but it was too dark to see anything; then she looked at the sides of the well, and noticed that they were filled with cupboards and book-shelves; here and there she saw maps and pictures hung upon pegs. She took down a jar from one of the shelves as she passed; it was labelled 'ORANGE MARMALADE', but to her great disappointment it was empty: she did not like to drop the jar for fear of killing somebody, so managed to put it into one of the cupboards as she fell past it.

'Well!' thought [redacted] to herself, 'after such a fall as this, I shall think nothing of tumbling down stairs! How brave they'll all think me at home! Why, I wouldn't say anything about it, even if I fell off the top of the house!' (Which was very likely true.)

Down, down, down. Would the fall *never* come to an end! 'I wonder how many miles I've fallen by this time?' she said aloud. 'I must be getting somewhere near the centre

Figure 2: pdfsweep redacted output document

As is made clear by this example document (and the code to go with it), it is perfectly possible to define a custom color for each snippet of text to be redacted.

Similarly, you could also have specified the exact locations yourself. Following code-snippet demonstrates that use case:

```
String input = "iphone_user_guide_untagged.pdf";
String output = "iphone_user_guide_redacted.pdf";

// load licensekey
LicenseKey.loadLicenseFile("itext_dev_master_license.xml");

// define rectangles
List<Rectangle> rects = Arrays.asList(  new Rectangle(60f, 80f, 460f, 65f),
                          new Rectangle(300f, 370f, 215f, 260f)
                        );

// turn rectangles into cleanup locations
int pagesNum = 130;
List<PdfCleanUpLocation> cleanUpLocations = new ArrayList<>();
for (int i = 0; i < pagesNum; ++i) {
  for (int j = 0; j < rects.size(); ++j) {
    cleanUpLocations.add(new PdfCleanUpLocation(i + 1, rects.get(j)));
  }
}

// open document
PdfDocument pdfDocument = new PdfDocument(new PdfReader(input), new PdfWriter(output));

// perform cleanup
PdfCleanUpTool cleaner = new PdfCleanUpTool(pdfDocument, cleanUpLocations);
cleaner.cleanUp();

// close document
pdfDocument.close();
```

Alternative example

In an alternative workflow, you can add human verification:

- Select those parts of the document that must be redacted.
- Call pdfAutoSweep with the method tentativeCleanUp. This will produce a document where the content was not actually redacted, but where all content that supposedly must be redacted is marked with an annotation. Adobe Acrobat can manage these annotations for you, allowing you to remove redaction annotations, add extra annotations, and add comments.
- Once you have made your final selection about which redaction annotations to keep, you can hit "apply redaction" in Adobe Acrobat.

‘Redacting’ Image elements

The previous examples mostly showcase how to use pdfSweep on text. Redaction can also be performed on images. Images are automatically redacted when they intersect with the rectangles the user provided. The redacted areas are covered with a colored rectangle, and the underlying image is changed (to prevent image extraction from yielding the original image.)

Figure 3: Tony Soprano as displayed in the original PDF document

Figure 4: Tony Soprano as displayed after the eyes have been redacted to provide anonymity

Figure 5: Extracted image of Tony Soprano. Notice that the original content is gone

How does pdfAutoSweep work?

1. The end user can specify a regular expression, and optionally a color.
2. The document is processed a first time, all instructions in the PDF document that relate to text rendering are processed. All characters along with their bounding rectangles in the document are stored.
3. These intermediate data structures are sorted so that all characters are now in logical (reading) order.
4. The regular expression(s) provided by the user are matched.
5. The information about where the match took place, and the bounding rectangles of the characters involved provide pdfSweep with the rectangles that need to be redacted.

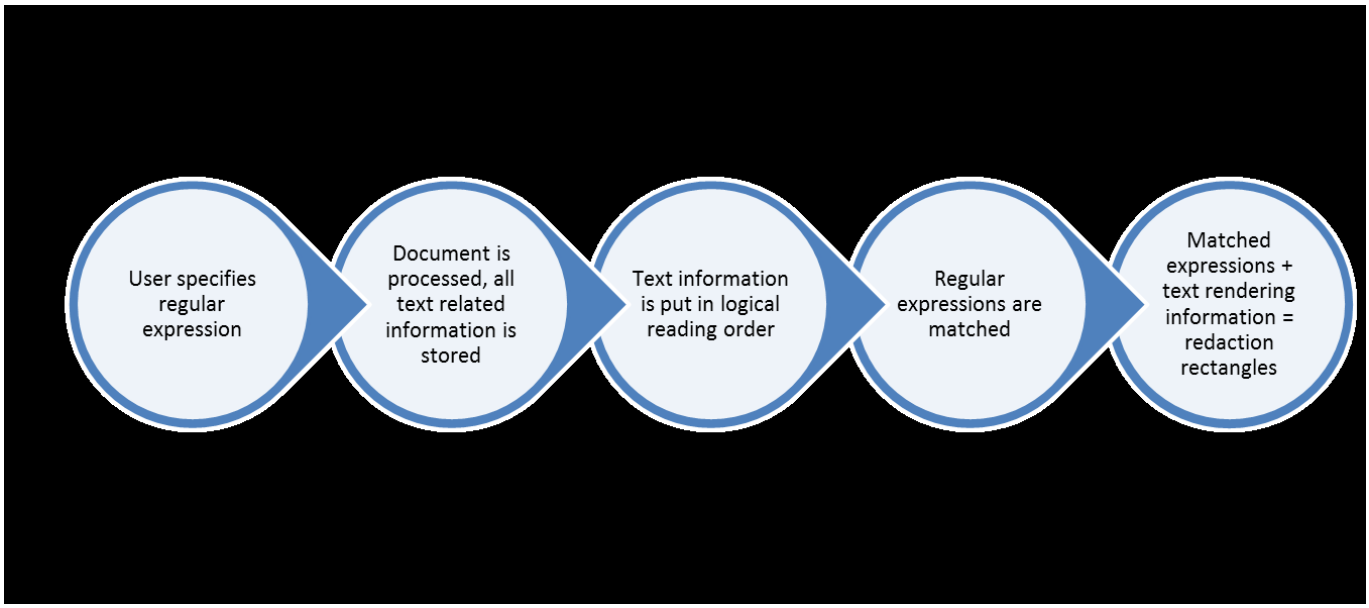


Figure 6: pdfAutoSweep workflow

Pre-configured regular expressions

Most of the regular expressions that are already configured to work with pdfAutoSweep are inspired by the O' Reilly reference work "Regular Expressions Cookbook" (Jan Goyvaerts and Steven Levithan, 978-1-449-31943-4). What follows is a short listing of some of these regular expressions and their intended matches.

NAME	MATCHES
ROMAN_NUMERALS_STRICT	a Roman number, matching only those numbers that are valid.
ROMAN_NUMERALS_FLEXIBLE	a Roman number, also matching IIII (4), whereas STRICT only matches IV
US_SOCIAL_SECURITY_NUMBER	a US social security number (ddd-dd-dddd)

NAME	MATCHES
US_ZIP_CODE	a US zip code (either 5 digit format, or 5+4 format)
US_CURRENCY	an amount of US dollars
CANADA_ZIP_CODE	a Canadian zip code
UK_ZIP_CODE	a UK zip code
DATE_MM_DD_YYYY	a date, specified in MM/DD/YYYY, separator can be 'space' '/' or '-'
DATE_MM_DD_YYYY_HH_MM_SS	a date, specified in MM/DD/YYYY HH:MM:SS
DATE_DD_MM_YYYY	a date, specified in DD/MM/YYYY, separator can be 'space' '/' or '-'
DATE_DD_MM_YYYY_HH_MM_SS	a date, specified in MM/DD/YYYY HH:MM:SS
IPV4_ADDRESS	an Internet Protocol (v4) address
IPV6_ADDRESS	an Internet Protocol (v6) address
MAC_ADDRESS	a Media Access Control address
EMAIL_ADDRESS	an email address
HTTP_URL	a url

Performance

To give a brief idea of the performance of pdfSweep, we've used the iPhone user manual as a reference. We've redacted the regular expression "(i|l)Phone". You can imagine this occurs quite a lot in that document.

Where "copies" signifies how many times the original input document was concatenated with itself. E.g. 4 copies means the document (of 130 pages) was concatenated 4 times (resulting in 520 pages).

Here are the results

COPIES	#PAGES	#INPUT FILE SIZE (MB)	#MILLISECONDS
1	130	3.23	6407
2	260	5.55	10253
4	520	11.1	17946
8	1040	22.5	23445

From this table we can clearly see pdfSweep performs linearly in relation to the size of the input document.

Conclusion

In this whitepaper, we've briefly presented our add-on pdfSweep. pdfSweep allows you to seamlessly integrate data redaction in your existing workflow. Redaction rectangles have to be defined, either by using pdfAutoSweep which uses regular expressions to search for matching text and coordinates, or by programmatically entering the coordinates. pdfSweep will redact both text and images ensuring complete confidentiality.

Learn more at https://itextpdf.com/itext7/pdfSweep