

¹ Handprint: a program to explore and compare major
² cloud-based services for handwritten text recognition

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Software

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Summary

⁸ Handprint (***Handwritten page recognition test***) is a command-line application that can invoke
⁹ cloud-based services to perform handwritten text recognition (HTR) on images of documents.
¹⁰ It accepts images in various popular formats, sends them to service providers, gathers the
¹¹ results, annotates copies of the images to show the results to the user, and optionally performs
¹² other operations. It currently supports HTR services from Amazon ([Amazon, Inc., 2022a](#),
¹³ [2022b](#)), Google ([Google, Inc., 2022](#)), and Microsoft ([Microsoft, Inc., 2022](#)), but its architecture
¹⁴ is modular and could be extended to other services. Handprint is a command-line program
written in Python and can run on macOS, Windows, and Linux computers.

Statement of need

¹⁵ The goal of automating the recognition of text dates back, at minimum, to efforts in the
¹⁶ 1950's to develop machines for banking applications ([Berkeley, 1956](#); [Dimond, 1957](#)). The early
¹⁷ methods were extremely limited in scope: they focused essentially on numbers only. Thanks to
¹⁸ decades of advances in machine learning, document analysis, and computing power, methods
¹⁹ have become so advanced that they can now be used to recognize cursive handwriting in dozens
²⁰ of human languages ([Muehlberger et al., 2019](#)). Today, handwritten text recognition (HTR) is
²¹ even offered as a service by several computing companies over the Internet, on demand, for
²² small fees—without the need to first train a system on samples of a person's handwriting. The
²³ recognition results are remarkably good overall, but there are differences in quality and features
²⁴ between the different offerings. Comparing the results produced by the competing services is
²⁵ complicated by the fact that they each have unique application programming interfaces (APIs).

²⁶ The purpose of Handprint is to make it easier to test HTR services and compare the results,
²⁷ without the need for users to learn how to write program or work with the different APIs. With
²⁸ Handprint, users can easily test cloud-based HTR services on individual images, directories of
²⁹ images, and URLs pointing to images on remote servers, all without writing a line of code. If
³⁰ desired, users can also use Handprint in scripts as part of automated workflows.

Summary of Handprint usage

Configuration

³³ The only configuration necessary after installation is to run Handprint with a command-line
³⁴ option to store the user's account credentials for each cloud-based HTR service provider. The
³⁵ command needs to be run once for each desired provider, and thereafter, Handprint will use
³⁶ the account information automatically. The documentation at <https://caltechlibrary.github.io/handprint/> explains the simple file format in which the credentials need to be written.

38 Basic features

39 Handprint can read many common image formats: JP2, JPEG, PDF, PNG, GIF, BMP, and
 40 TIFF. Image paths or URLs can be supplied to Handprint in any of the following ways: (a)
 41 one or more directory paths or one or more image file paths on the local disk, which will be
 42 interpreted as images—either individually or in directories—to be processed; (b) one or more
 43 URLs, which will be interpreted as network locations of image files to be processed; or (c) if
 44 given the -f command-line option (/f on Windows), a file containing either image paths or
 45 image URLs to be processed. When using URLs, Handprint first downloads the image found
 46 at the given URL(s) to a directory of the user's choosing on the local disk. No matter whether
 47 files or URLs, each item should be an image of a single document page containing text.

48 Handprint's basic features include the ability to select a subset of services to use, save the
 49 full raw results from HTR services as JSON or text files, and use multiple processor threads
 50 to speed up processing. For example, using one of the sample images found in Handprint's
 51 source directory, the following command,

52 `handprint --text-size 20 --display text,bb-line H96566k.jpg`

53 will send image file H96566K.jpg to all services currently supported (Amazon Rekognition and
 54 Texttract, Google Cloud Vision, and Microsoft Azure Computer Vision). The output will be a
 55 file named H96566k.handprint-all.png with the contents shown in Figure 1.

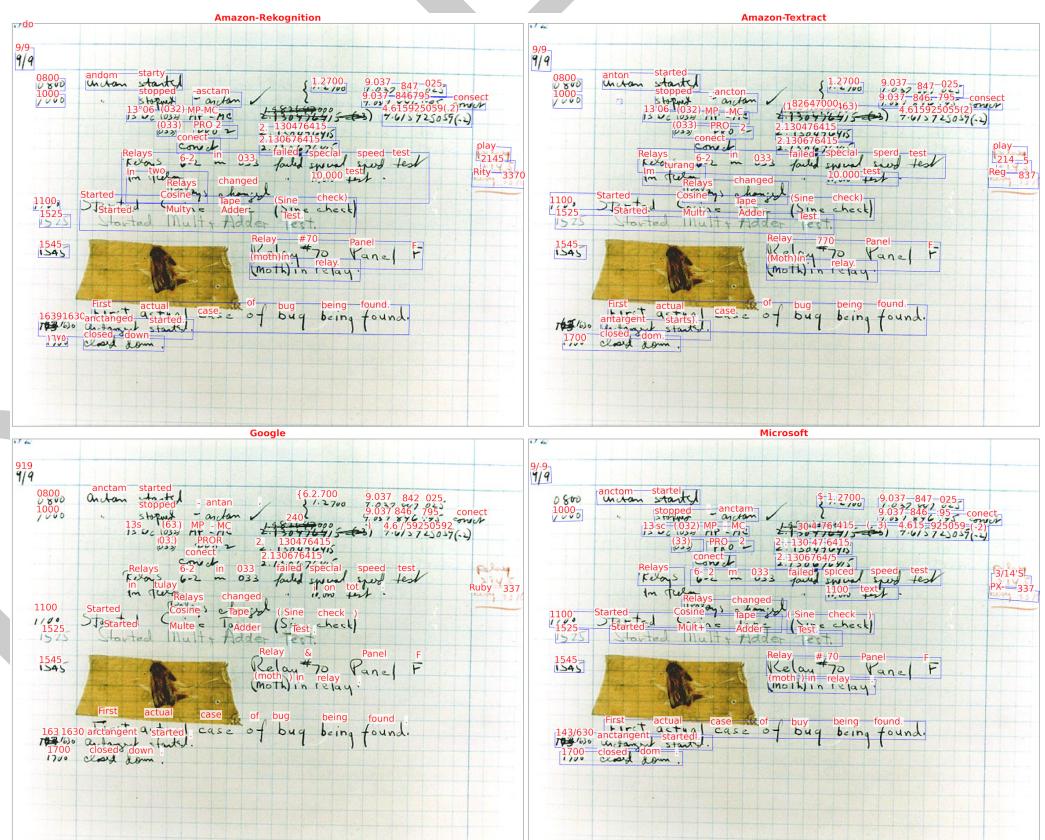


Figure 1: Sample output from Handprint. (Source image: Wikipedia ([Wikipedia contributors, 2012](#)).)

56 Users can opt to skip the creation of the overview grid image if they only need the other
 57 types of outputs that Handprint can produce.

58 Advanced features

59 Handprint also includes additional, more advanced features, including the following:

- 60 ■ *Controlling the style and placement annotations overlaid on input images.* Users control
61 whether to display recognized text, bounding boxes, or both, and which types of bounding
62 boxes (word, line, and/or paragraph—although not all services provide all types).
- 63 ■ *Filtering the results by confidence scores.* This allows users to see which words or other
64 components have confidence values that meet or exceed a chosen threshold.
- 65 ■ *Comparing text results to expected (ground truth) text.* Users can supply a text file
66 containing the expected text for a given image, and Handprint will calculate the number
67 of errors and the character error rate for each line. The comparison algorithm has some
68 novel capabilities, notably in how it can treat missing, extra, or transposed lines of text
69 from the HTR results (a common difference between the outputs of different services).

70 Documentation

71 A detailed user manual is available at <https://caltechlibrary.github.io/handprint/>. Handprint
72 also prints usage information to the terminal when given the command-line option --help.

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