

# Chapter 13

## Flowchart Recognition in Patent Information Retrieval

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**Abstract** In this chapter, we will analyse the current technologies available that deal with graphical information in patent retrieval applications and, in particular, with the problem of recognising and understanding information carried by flowcharts. We will review some of the state-of-the-art techniques that have arisen from the graphics recognition community and their application in the intellectual property domain. We will present an overview of the different steps that compound a flowchart recognition system, looking also at the achievements and remaining challenges in such a domain.

### 13.1 Introduction

A patent can be defined as a legal title protecting a technical invention for a limited period. Patent documents consist of three parts mainly [10]. First, a front page presenting general information about the patent, such as the title, the summary of the invention, the name of the inventors, etc. Second, the technical description, which details the technical problem the invention solves as well as the state of the art and the novelty of the invention. Finally, a claims section that defines the intellectual property (IP) protection rights, i.e. a clear description of what is legally protected. In each of these parts, drawings can be (and are often) used to provide an accurate detailed description of intermediate parts of the invention.

Since patent documents include both technical and legal information, conducting a patent search is of extreme importance for several purposes [11]. The technical part of patents, as in the case of scientific publications, defines the state of the art for a given problem and can be used to find out what already exists and to check the novelty of a given invention. Concerning the legal aspects, they can also be used in order to assess the freedom to operate, i.e. make sure we are not infringing someone else's IP rights, or to check whether someone might be infringing our own IP rights.

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However, performing searches in the patent's content might not be a straightforward task.

First of all, there is the scale factor. Just in 2013, 265,900 European patent filings were made at the European Patent Office (EPO),<sup>1</sup> representing a 2.8 % growth with respect to the last year. And as of today, nearly 80 million patent documents worldwide are available through the publicly available patent database Espacenet.<sup>2</sup> Conducting efficient and effective searches in such large-scale and ever-growing scenarios is by itself a difficult problem.

Secondly, we have the semantic problem. Patents being written in an 'unstructured' manner in natural language entail the same problematics of any textual search from the information retrieval (IR) field. When searching for a patent, the user has to select a list of keywords that define the invention he/she is looking for. Finding keyword synonyms, avoiding the use of homonyms and using Boolean operators to regroup the terms in order to cast a good query are of critical importance [10].

Finally, it is worth to mention that not all the information in a patent document is conveyed by textual elements. Drawings in patents play an important role since in many patent filings the technical details are depicted rather than being explicitly written in textual format. Drawings can be of different nature, including line drawings, figures, diagrams, flowcharts, plots, etc. As pointed by many authors, e.g. Bhatti and Hanbury in [2], Hanbury et al. in [15] and Lupu et al. in [26], the inspection of visual information conveyed by such drawings is becoming overwhelmingly important in order to assess the novelty of a submitted patent. However, nowadays most of the patent search applications fail to exploit non-textual information [1, 23].

It is worth to note the efforts made within the CLEF initiative concerning the problem of dealing with non-textual information in the IP domain. Until 2011, the CLEF-IP track served as a benchmarking activity on prior art retrieval focusing only on textual patent documents. However, in 2011 two image-based tasks were added [30]: one devoted to find patent documents relevant to a given patent document which contained images and another aimed at categorising patent images into predefined categories of images (such as graphs, flowcharts, drawings, etc.). In CLEF-IP 2012 [31], a new image-based task was proposed: the flowchart recognition task dealing with the interpretation of flowchart line drawing images. The participants were asked to extract as much structural information as possible from these images and return it in a predefined textual format for further processing for the purpose of patent search. Three different institutions participated in such a task [29, 34, 42]. We will overview such approaches and put them in context throughout the rest of this chapter. We will analyse the current technologies available that deal with graphical information in the patent retrieval application. We will review some of the state-of-the-art techniques arisen from the graphics recognition community and their application in the IP domain. Specifically, we will focus on the problem of recognising and understanding information carried by flowcharts.

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<sup>1</sup><http://www.epo.org/about-us/annual-reports-statistics.html>.

<sup>2</sup><http://www.epo.org/searching/free/espacenet.html>.