White Paper

Text Clustering on Patents

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Overview

Amongst various analyses performed on patents, the area where specialized software helps immensely is text-mining and two of the most popular text mining techniques used over patent data are:

- Text segmentation / Tokenization
- Text Clustering / Topic identification

Text segmentation is a process of analyzing the patent text and identifying smaller meaningful segments from the text. These segments are also called as Tokens or keywords. Various analyses can be performed using these tokens; however for large patent sets the number of unique tokens can be very high thereby making it unsuitable for certain types of analyses.

Text clustering helps identify important topics or concepts (clusters) from a set of documents. Clustering of key patent data documents (such as Title, Abstract and Claims) has been used in various Patent Analysis tools and can help bring out the otherwise hidden insights within patents. Analyzing relationships between generated clusters or analyzing relationships between patent classifications and clusters are popular mechanisms used by researchers especially those in a competitive intelligence role.

Clustering Algorithms

Classical algorithms used for clustering are TF-IDF, K-Means or Bayesian Naïve. Their output is a set of topics (single level or hierarchical with multiple levels), each of which contain a group of documents cluster under the topic. The label (or name) of a topic is derived from the text of the patent and can be a combination of multiple words. Usually advanced algorithms understand parts-of-speech and interpret names accordingly. For instance, "tip of the probe…", "using a probe tip…", "with a probe whose tip is used for…", and "probing the substrate with the tip…" will be represented as "probe tip".

Algorithms can differ on their capability to cluster patent under single or multiple topics. For patents it is desirable to have algorithms that place a patent under more than one topic since an attempt make a best-match for the patent under a single topic may lead to errors in user interpretation.

One of the key challenges of clustering algorithms has been to make the overall process transparent for IP Professionals who usually find it hard to accept results of "black-box" clustering engines. Newer clustering algorithms provide the analyst control over most aspects of the clustering process thereby allowing then to fine tune the clustering output and train the algorithm to deliver more relevant results. The analyst can also now specify how deep s/he wants to go and choose to highlight broader or finer (more specific) topics.

Another challenge has been to make it easy for the analyst to influence the choice of the terms being picked up such to avoid picking up meaningless terms or to give importance to a certain *class* of terms. Apart from just being able to ignore some words (stop-words) it is important to have the power to set advanced filters that decide the choice of the labels used to represent the topic. For instance these can be, whether to ignore or give more importance to - words in ALL Caps, words starting with or containing a number, words containing more than one hyphen (compound names) or just words that are too long or too short. Even a minor change using such filters can have a reasonable effect on the topics that are chosen.

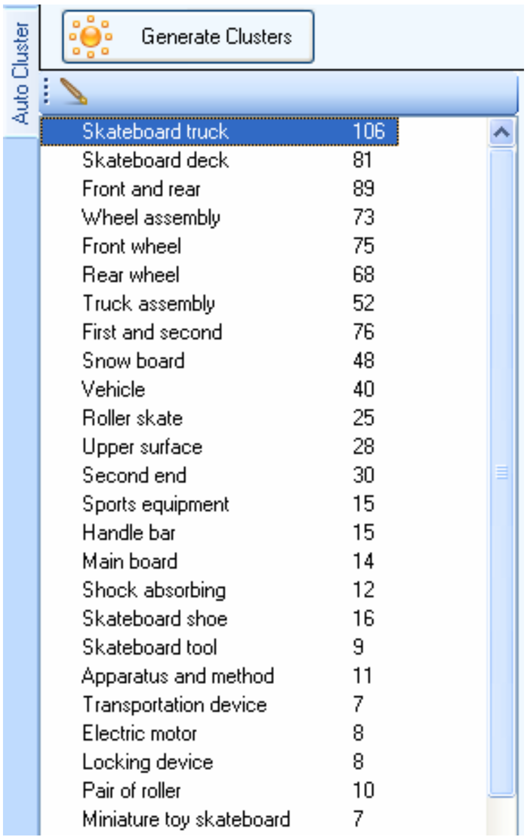
Benefits of Text Clustering on Patents (Use Case Scenario)

Lets understand the benefits of patent text clustering using a sample case use case scenario. on patents related to **skateboards**.

In this sample set, we did a simple search for the word "skateboard" in Title, Abstract and Claims of patents across key countries and then de-duplicated the results to only unique families. This resulted in 552 unique inventions.

Text clustering was then performed using Patent iNSIGHT Pro* over the Title, Abstract and Claims sections of these patents and the results obtained are illustrated below. We have used the sub-topics on Skateboards used in Wikipedia as a sample for cross-reference.

Table: Automatic Clustering vs Manual Categorization

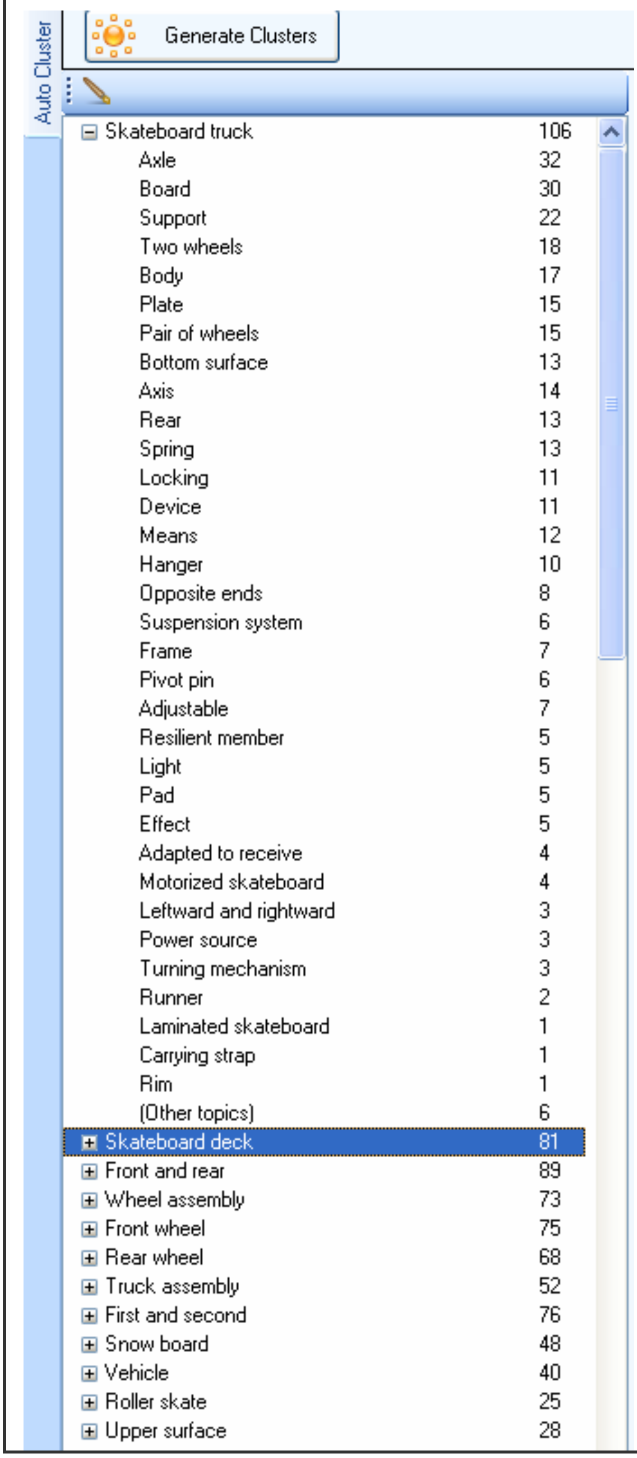
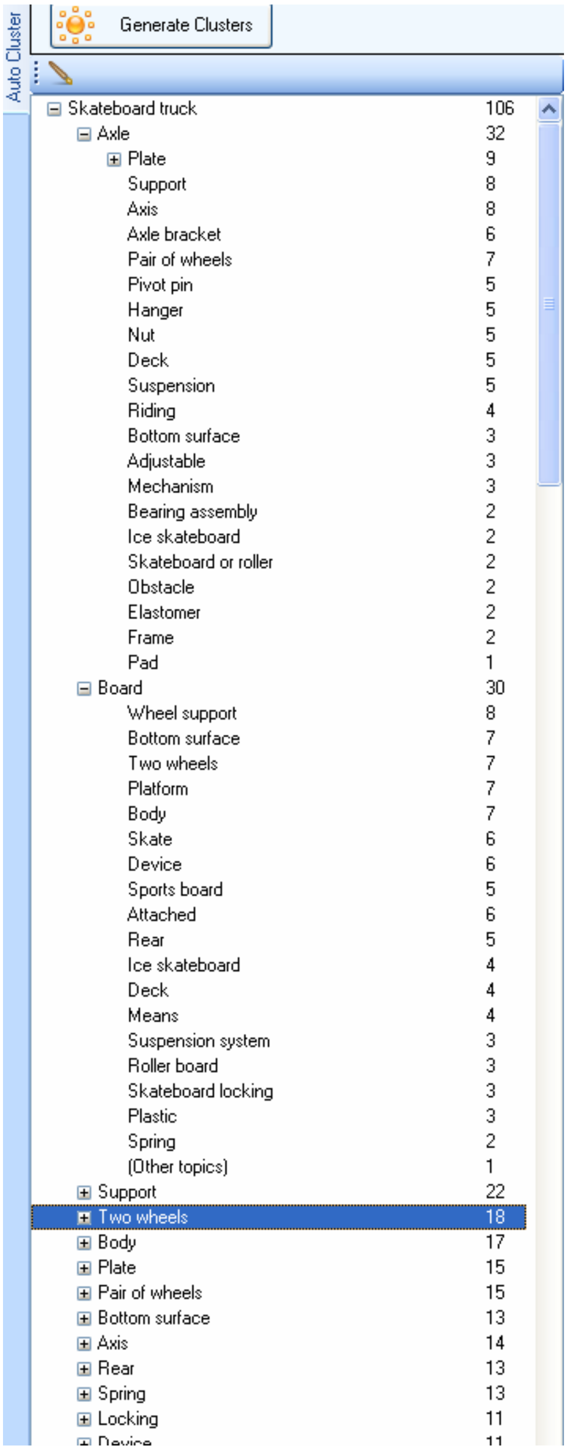
Single level Categorization by Patent iNSIGHT Pro **Keyword: "Skateboard" in T-A-C**	**Categorization in Wikipedia** **Reference: http://en.wikipedia.org/wiki/Skateboard**
 Skateboard truck 106 Skateboard deck 81 Front and rear 89 Wheel assembly 73 Front wheel 75 Rear wheel 68 Truck assembly 52 First and second 76 Snow board 48 Vehicle 40 Roller skate 25 Upper surface 28 Second end 30 Sports equipment 15 Handle bar 15 Main board 14 Shock absorbing 12 Skateboard shoe 16 Skateboard tool 9 Apparatus and method 11 Transportation device 7 Electric motor 8 Locking device 8 Pair of roller 10 Miniature toy skateboard 7	**Contents** 1 History 2 Parts 2.1 Deck 2.2 Trucks 2.3 Wheels 2.4 Bearings 2.5 Hardware 3 Optional components 3.1 Rails 3.2 Slip Tape 3.3 Lapper 3.4 Nose guard 3.5 Tail guard 3.6 Angled risers 4 References

* Note- A new Advanced Clustering engine has been recently added to Patent iNSIGHT Pro

As can be seen, clustering algorithm outputs do overlap to a large extent with standard human developed classifications.

Multi-level (hierarchical) clustering algorithms allow analyst to further sub-divide these clusters and see how each topic is further broken down. In the current example, we set the clustering engine to generate 2-level and 3-level clusters:

Table: Hierarchal Clustering

2-level categorization by Patent iNSIGHT Pro	3-level categorization by Patent iNSIGHT Pro
	

```
⊟ Skateboard truck                106
      Axle                         32
      Board                        30
      Support                      22
      Two wheels                   18
      Body                         17
      Plate                        15
      Pair of wheels               15
      Bottom surface               13
      Axis                         14
      Rear                         13
      Spring                       13
      Locking                      11
      Device                       11
      Means                        12
      Hanger                       10
      Opposite ends                 8
      Suspension system             6
      Frame                         7
      Pivot pin                     6
      Adjustable                    7
      Resilient member              5
      Light                         5
      Pad                           5
      Effect                        5
      Adapted to receive            4
      Motorized skateboard          4
      Leftward and rightward        3
      Power source                  3
      Turning mechanism             3
      Runner                        2
      Laminated skateboard          1
      Carrying strap                1
      Rim                           1
      (Other topics)                6
⊞ Skateboard deck                  81
⊞ Front and rear                   89
⊞ Wheel assembly                   73
⊞ Front wheel                      75
⊞ Rear wheel                       68
⊞ Truck assembly                   52
⊞ First and second                 76
⊞ Snow board                       48
⊞ Vehicle                          40
⊞ Roller skate                     25
⊞ Upper surface                    28
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⊟ Skateboard truck                106
  ⊟ Axle                           32
    ⊞ Plate                         9
      Support                       8
      Axis                          8
      Axle bracket                  6
      Pair of wheels                7
      Pivot pin                     5
      Hanger                        5
      Nut                           5
      Deck                          5
      Suspension                    5
      Riding                        4
      Bottom surface                3
      Adjustable                    3
      Mechanism                     3
      Bearing assembly              2
      Ice skateboard                2
      Skateboard or roller          2
      Obstacle                      2
      Elastomer                     2
      Frame                         2
      Pad                           1
  ⊟ Board                          30
      Wheel support                 8
      Bottom surface                7
      Two wheels                    7
      Platform                      7
      Body                          7
      Skate                         6
      Device                        6
      Sports board                  5
      Attached                      6
      Rear                          5
      Ice skateboard                4
      Deck                          4
      Means                         4
      Suspension system             3
      Roller board                  3
      Skateboard locking            3
      Plastic                       3
      Spring                        2
      (Other topics)                1
  ⊞ Support                        22
  ⊞ Two wheels                     18
  ⊞ Body                           17
  ⊞ Plate                          15
  ⊞ Pair of wheels                 15
  ⊞ Bottom surface                 13
  ⊞ Axis                           14
  ⊞ Rear                           13
  ⊞ Spring                         13
  ⊞ Locking                        11
  ⊞ Device                         11
```
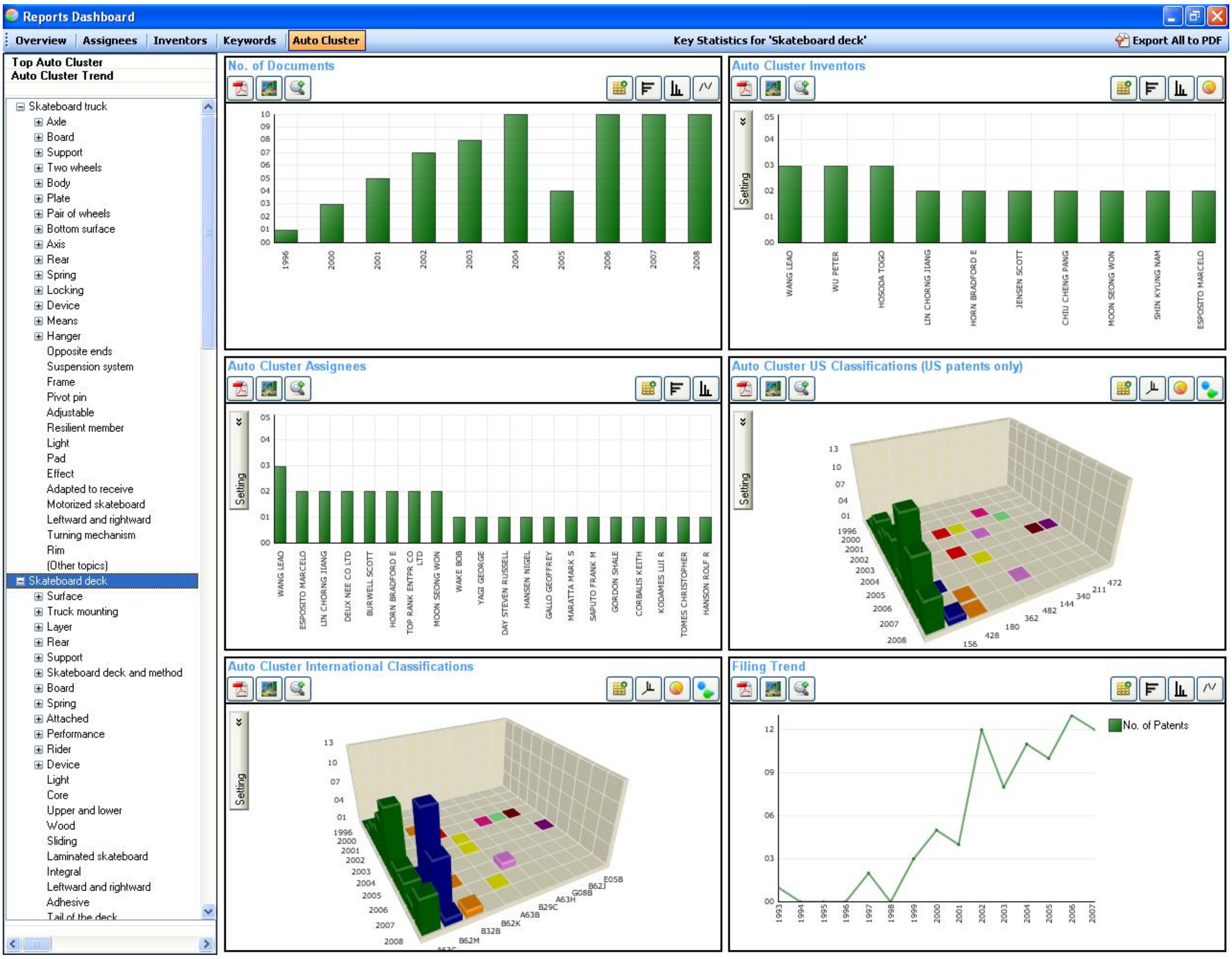

Hierarchies (like above) are of immense help when you are developing your own internal classifications (also referred to as taxonomy). They help you cross check and refine the categories you created. Having IP portfolios mapped with well-defined industry specific internal classification is popular within large corporations.

An obvious use is to quickly view the trends (as shown below) across clusters and get the big picture on how your companies portfolio is spread out, or understand which technologies are becoming mature and phasing out and which are the new “focus areas” that are coming up.



A lateral benefit is that these clusters can also be used as means to speed up shifting through large sets of patent data or narrowing down to the specific technology or area you are interested in.

When categorizing patents, it is sometimes important to map a portfolio to actual market products to see how various technologies and IPs are spread or to see a bigger picture by correlating parameters such as the market size of each product or your financials (costs/revenue) behind each product. For creating such product-patent mapping, the analyst can merge or map algorithm generated clusters rather than individually mapping each patent to the products and in this way, drastically reduce the time taken to categorize large patent sets.

Summary of Benefits

To sum up the benefits, patent text clustering can be used:

- To reduce time taken to categorize large sets of patents
- To enhance scanning efficiency and to narrow down on a specific area
- To identify sub-topics, discover hidden topics and understand the trends and competitive focus in each topic
- To develop internal taxonomies or as a reference to cross-check and improve your manually prepared categories
- To reduce time taken to develop advanced categorizations such as product-patent mapping or market-patent mapping
- As a new dimension to analyze along with standard bibliographic fields (for trend analysis and competitive landscaping)
- And, as a reference to refine your search strategy.

About Patent iNSIGHT Pro

Patent iNSIGHT Pro™ is a comprehensive patent analysis platform that allows you to accelerate your time-to-decision from patent analysis activities. Designed from inputs by experienced patent researchers, Patent iNSIGHT Pro easily blends into your existing Research workflow. Patent iNSIGHT Pro is used by leading legal services, Pharmaceutical & biotech, electronics companies and research organization across US, Europe, South America and India with more than 150 end users. Patent iNSIGHT Pro is developed and marketed by Gridlogics, a research driven IT Company specializing in providing intellectual property analysis and visualization solutions to aid R&D and corporate strategy.

Gridlogics is headquartered in Pune, India and has a sales presence in Delhi, Mumbai and USA.

For more information:

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