Chapter 1

Search Engines and Search Strings

1.1 ACM digital library

Search strings used:

- String 1 (the same string that gave the best result in IEEE Xplore):
  - ("path optimization" OR "scheduling optimization" OR "route optimization") AND (transit OR traffic OR transportation OR vehicle OR train OR plane OR bus OR delivery) AND ("bee colony optimization" OR "particle swarm optimization" OR "swarm intelligence" OR "ant colony optimization" OR pso OR bso OR aco)

  Number of results: 31

  Date of search: 29.10.2014

- String 2 (switched the first AND with an OR to get a more general result):
  - (("path optimization" OR "scheduling optimization" OR "route optimization" OR transit OR traffic OR transportation OR vehicle OR train OR plane OR bus OR delivery) AND ("bee colony optimization" OR "particle swarm optimization" OR "swarm intelligence" OR "ant colony optimization" OR pso OR bso OR aco))

  Number of results: 1,294

  Date of search: 29.10.2014

- String 3 (removed some less relevant word, such as schduling optimization, transit and plane):

- (("path optimization" OR "route optimization" OR transportation OR vehicle OR bus) AND ("bee colony optimization" OR "particle swarm optimization" OR "swarm intelligence" OR "ant colony optimization" OR pso OR bso OR aco))

Number of results: 622

Date of search: 29.10.2014

- String 4 (in addition a search was done were we added the terms "neo4j" and "graph database" for the search string that originial gave the most results. Non of the found papers were relevant):
  - (("path optimization" OR "scheduling optimization" OR "route optimization" OR transit OR traffic OR transportation OR vehicle OR train OR plane OR bus OR delivery) AND ("bee colony optimization" OR "particle swarm optimization" OR "swarm intelligence" OR "ant colony optimization" OR pso OR bso OR aco) AND (neo4j OR "graph database"))

  Number of results: 4

  Date of search: 29.10.2014

1.2 ScienceDirect

Qoute Sandsmark: ScienceDirect is an aggregator of articles and other sources for a wide range of domains, including finances and medicine, as well as computer science.

Only searched in publications in the subject of computer science. Papers published between 1970 and now.

Search strings used:

- String 1
  - ("path optimization" OR "scheduling optimization" OR "route optimization") AND (transit OR traffic OR transportation OR vehicle OR train OR plane OR bus OR delivery) AND ("bee colony optimization" OR "particle swarm optimization" OR "swarm intelligence" OR "ant colony optimization" OR colony OR pso OR bso OR aco)

  Number of results: 126

  Date of search: 29.10.2014

- String 2 (Not enough results. Made it more general by removing AND's and adding OR's)

- ((“path optimization” OR “route optimization” OR transportation OR vehicle OR bus) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco))

Number of results: 2971

Date of search: 29.10.2014

- String 3 (Too general. Added “artificial intelligence” and AI)
  - ((“path optimization” OR “route optimization” OR transportation OR vehicle OR bus) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco)) AND (“artificial intelligence” OR ai)

Number of results: 1459

Date of search: 29.10.2014

- String 4 (Still too general. Added “routing”)
  - ((“path optimization” OR “route optimization” OR transportation OR vehicle OR bus) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco)) AND (“artificial intelligence” OR ai) AND routing

Number of results: 535

Date of search: 29.10.2014

- String 5 (in addition a search was done were we added the terms “neo4j” and “graph database” for the search string that originial gave the most results. Non of the found papers were relevant or indicates that our idea has been done before)
  - ((“path optimization” OR “route optimization” OR transportation OR vehicle OR bus) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco) AND (neo4j OR “graph database”)

Number of results: 4

1.3 CiteSeer

Search strings used:

- String 1 (Used the query with the most results from the previous search engine.)

  - text:(((“path optimization” OR “route optimization” OR transportation OR vehicle OR bus) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco)))

  Number of results: 4533

  Date of search: 30.10.2014

- String 2 (This query gave too many results, added (“artificial intelligence” OR “ai”) AND “routing”)

  - text:(((“path optimization” OR “route optimization” OR transportation OR vehicle OR bus) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco)) AND (”artificial intelligence” OR ai) AND routing)

  Number of results: 327

  Date of search: 30.10.2014

- String 3 (in addition a search was done were we added the terms “neo4j” and “graph database” for the search string that originial gave the most results. Non of the found papers were relevant or indicates that our idea has been done before)

  - text:(((“path optimization” OR “route optimization” OR transportation OR vehicle OR bus) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco) AND (neo4j OR “graph database”))

  Number of results: 4

  Date of search: 30.10.2014

1.4 SpringerLink

Search strings used:

- String 1 (Used the best query from the previous search engine, and this gave a good result.)

  - (“path optimization” OR “scheduling optimization” OR “route optimization”) AND (transit OR traffic OR transportation OR vehicle OR train OR plane OR bus OR delivery) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR colony OR pso OR bso OR aco)

  Number of results: 403

  Date of search: 03.11.2014

- String 2 (in addition a search was done were we added the terms “neo4j” and “graph database” for the search string that originial gave the most results. Non of the found papers were relevant or indicates that our idea has been done before)
  - (“path optimization” OR “scheduling optimization” OR “route optimization”) AND (transit OR traffic OR transportation OR vehicle OR train OR plane OR bus OR delivery) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR colony OR pso OR bso OR aco) AND (neo4j OR “graph database”)

  Number of results: 0

  Date of search: 03.11.2014

1.5 Google Scholar

Google scholar does not accept long queries. The result is all the queries/results combined.

Search strings used:

- String 1 (“bee colony optimization”)
  - (“path optimization” OR “route optimization”) AND (transportation OR bus OR vehicle) AND (“artificial intelligence” OR ai) AND routing AND (“bee colony optimization” OR bco)

  Number of results: 13

  Date of search: 03.11.2014

- String 1 (with “neo4J” and “graph database”)
  - (“path optimization” OR “route optimization”) AND (transportation OR bus OR vehicle) AND (“artificial intelligence” OR ai) AND routing AND (“bee colony optimization” OR bco) AND (neo4j OR “graph database”)

  Number of results: 0

  Date of search: 03.11.2014

- String 2 (“particle swarm optimization”)
  - (“path optimization” OR “route optimization”) AND (transportation OR bus OR vehicle) AND (“artificial intelligence” OR ai) AND routing AND (“particle swarm optimization” or pso)

  Number of results: 131

  Date of search: 03.11.2014

- String 2 (with “neo4J” and “graph database”)
  - (“path optimization” OR “route optimization”) AND (transportation OR bus OR vehicle) AND (“artificial intelligence” OR ai) AND routing AND (“particle swarm optimization” or pso) AND (neo4j OR “graph database”)

  Number of results: 0

  Date of search: 03.11.2014

- String 3 (“swarm intelligence”)
  - (“path optimization” OR “route optimization”) AND (transportation OR bus OR vehicle) AND (“artificial intelligence” OR ai) AND routing AND “swarm intelligence”)

  Number of results: 148

  Date of search: 03.11.2014

- String 3 (with “neo4J” and “graph database”)
  - (“path optimization” OR “route optimization”) AND (transportation OR bus OR vehicle) AND (“artificial intelligence” OR ai) AND routing AND “swarm intelligence” AND (neo4j OR “graph database”)

  Number of results: 0

  Date of search: 03.11.2014

- String 4 (“ant colony optimization”)
  - (“path optimization” OR “route optimization”) AND (transportation OR bus OR vehicle) AND (“artificial intelligence” OR ai) AND routing AND (“ant colony optimization” OR aco)

  Number of results: 308

  Date of search: 03.11.2014

- String 4 (with “neo4J” and “graph database”)
  - (“path optimization” OR “route optimization”) AND (transportation OR bus OR vehicle) AND (“artificial intelligence” OR ai) AND routing AND (“ant colony optimization” OR aco) AND (neo4j OR “graph database”)

  Number of results: 0

  Date of search: 03.11.2014

1.6 Web of Knowledge

In the web of knowledge you can not perform at full text search, and must choose to search in "Topic", "Title", "Author", "Author Identifiers", "Editor", "Group Author", "Publication Name", "DOI" or "Year Published". We decided to use "Topic", "Title" and "Publication Name" because the seemed most relevant to our search terms. Non of our search terms gave any results when we searched for "Publication Name". Only some of the search terms gave results when we searcher for "Title". The fifth result is considered the best, and in this search we used the exact same search terms as in the forth search, but we chose to only search in articles from the research area "Computer Science".

Search strings used:

- String 1 (Used the best result from SpringerLink, but this gave too little results)
  - ("path optimization" OR "route optimization" OR transportation OR vehicle OR bus) AND ("bee colony optimization" OR "particle swarm optimization" OR "swarm intelligence" OR "ant colony optimization" OR pso OR bso OR aco) AND ("artificial intelligence" OR ai) and routing

  Number of results: 6 (topic) + 0 (title) + 0 (publication name)

  Date of search: 03.11.2014

- String 2 (Made it more general, removed "routing")
  - ("path optimization" OR "route optimization" OR transportation OR vehicle OR bus) AND ("bee colony optimization" OR "particle swarm optimization" OR "swarm intelligence" OR "ant colony optimization" OR pso OR bso OR aco) AND ("artificial intelligence" OR ai)

  Number of results: 33 (topic) + 0 (title) + 0 (publication name)

  Date of search: 03.11.2014

- String 3 (Removed OR's)
  - ("path optimization" OR "scheduling optimization" OR "route optimization") AND ("bee colony optimization" OR "particle swarm optimization" OR "swarm intelligence" OR "ant colony optimization" OR pso OR bso OR aco)

  Number of results: 92 (Topic) + 14 (Title) + 0 (publication name)

  Date of search: 03.11.2014

- String 4 (Added "planning")

- (“path optimization” OR “scheduling optimization” OR “route optimization” OR planning) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco)

Number of results: 1583 (Topic) + 328 (Title) + 0 (publication name)

Date of search: 03.11.2014

When we searched for the exact same terms, but chose articles just from the research area “computer science” the results was much better.

- String 5
  - (“path optimization” OR “scheduling optimization” OR “route optimization” OR planning) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco)

  Number of results: 597 (Topic) + 149 (Title) + 0 (publication name)

  Date of search: 03.11.2014

- String 6 (in addition a search was done were we added the terms “neo4j” and “graph database” for the search string that originial gave the most results. Non of the found papers were relevant or indicates that our idea has been done before)
  - (“path optimization” OR “scheduling optimization” OR “route optimization” OR planning) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aco) AND (neo4j OR “graph database”)

  Number of results: 0 (Topic) + 0 (Title) + 0 (publication name)

  Date of search: 03.11.2014

1.7 IEEE Xplore

IEEE Xplore allows the option to search for either full text or metadata only. After reviewing the results, we see tat the retrieved papers from full text includes alot more than just research papers, e.g conference proceedings. When searching for metadata only instead (which searches within abstract, title and indexing terms), the results become more relevant. IEEE Xplore allows a maximum of 15 search terms, so we had to be selective with the terms and therefore only include the terms we think is the most relevant for out thesis. In addition, IEEE Xplore only retrieve papers from 2000 to 2014.

Search strings used:

- String 1 (Searching within full text)
  - (“path optimization” OR “scheduling optimization” OR “route optimization” OR transit OR transportation OR traffic OR vehicle) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aso) AND (”artificial intelligence” OR ai)

  Number of results: 4300

  Date of search: 29.10.2014

- String 2 (within metadata only):
  - (“path optimization” OR “scheduling optimization” OR “route optimization” OR bus OR transportation) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aso) AND (”artificial intelligence” OR ai)

  Number of results: 99

  Date of search: 06.11.2014

- String 2 (removing artificial intelligence and ai):
- (“path optimization” OR “scheduling optimization” OR “route optimization” OR transit OR transportation OR traffic OR vehicle) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aso)

  Number of results: 1526

  Date of search: 06.11.2014

- String 3 (removed transit and vehicle, added bus):
  - (“path optimization” OR “scheduling optimization” OR “route optimization” OR bus OR transportation) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aso)

  Number of results: 1378

  Date of search: 06.11.2014

- String 4 (removed scheduling optimization, added vehicle, ai and artificial intelligence):
  - (“path optimization” OR “route optimization” OR bus OR transportation OR vehicle) AND (“bee colony optimization” OR “particle swarm optimization” OR “swarm intelligence” OR “ant colony optimization” OR pso OR bso OR aso) AND (”artificial intelligence” OR ai)

Number of results: 133

Date of search: 06.11.2014

- The string with most results with neo4J and graph database
  - (("path optimization" OR "scheduling optimization" OR "route optimization") OR (transit OR transportation OR traffic OR vehicle)) AND ("bee colony optimization" OR "particle swarm optimization" OR "swarm intelligence" OR "ant colony optimization" OR pso OR bso OR aso) AND (neo4j OR "graph database")

  Number of results: 0

  Date of search: 06.11.2014

Chapter 2

Protocol

2.1 Search Terms

- Group 1: Train, plane, bus, delivery
- Group 2: Path optimization, Scheduling Optimization, Route Optimization, Planning
- Group 3: Bee colony optimization, Particle swarm optimization, Swarm intelligence, Ant colony optimization
- Group 4: Transit, Transportation, Traffic, Vehicle
- Group 5: Artificial Intelligence, ai
- Group 6: Multi-agent