The aim of this course is to train students in understanding the techniques and tools for describing social networks and the www. The course will teach techniques for ranking (ex. google’s pagerank for web pages), recommender systems (ex. amazon’s recommendations of similar products), Auctions of advertisements (i.e. google’s adwords), Finding influencers in social networks, finding communities in social networks, finding text similarity between documents by meaning (i.e. similarity between posts in blogs). In addition, a web search engine will be designed in python, and then the social graph will be created and the techniques explained in theory will be applied in a practical way.

### Prior skills
None

### Requirements
Knowledge of linear algebra and probability

### Teaching methodology
blackboard classes, individual work and simulations in python

### Learning objectives of the subject

### Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>26h</th>
<th>20.80%</th>
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<tbody>
<tr>
<td></td>
<td>Hours small group:</td>
<td>13h</td>
<td>10.40%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>86h</td>
<td>68.80%</td>
</tr>
</tbody>
</table>
## Ranking Systems

**Description:**
Description algorithms for sorting websites by relevance. Algorithms for graphs made of links between pages: Google's Pagerank and HITS. Practical examples.

**Related activities:**
Individual Deliverable.
Laboratory activities.

**Specific objectives:**
Understanding google's Pagerank and HITS equations from different points of view; flow graph, random walk, probability of visiting a node.
Understand the application examples.

### Social Networks as graphs

**Description:**
Techniques for finding influencers and communities in graphs. Specific properties of twitter type graphs and facebook type graphs. Practical examples.

**Related activities:**
Individual Deliverable.
Laboratory activities.

**Specific objectives:**
Understand the techniques to perform the partition of graphs in communities, techniques to find nodes of influence, techniques to model the effects of propagation of information in a viral manner.
Practical applications.
### Finding text similarity between documents by meaning. Application to twitter and blogs.

**Description:**
Bag of words model for texts, stemming and word-term matrix. Latent semantic analysis. Application to twitter and blog data.

**Related activities:**
- Individual Deliverable.
- Laboratory Practices.

**Learning time:** 15h
- Theory classes: 6h
- Practical classes: 3h
- Self study: 6h

### Recommender systems. Amazon/Netflix cases

**Description:**
Description of the recommender systems based on Collaborative and content based. Description of different recommender systems; amazon, netflix.

**Related activities:**
- Individual Deliverable.
- Laboratory activities.

**Specific objectives:**
Be able to adapt the general methods of recommender systems to specific situations.

**Learning time:** 10h
- Theory classes: 4h
- Practical classes: 2h
- Self study: 4h

### Auctions of web advertisements. Google Adwords case.

**Description:**
Description of systems for making auctions of online advertisements. Summary of the modified Vickrey auction system used by google's adwords.

**Related activities:**
- Individual Deliverable.
- Laboratory activities.

**Learning time:** 10h
- Theory classes: 4h
- Practical classes: 2h
- Self study: 4h
Individual assessments: 40%
Final examination: 60%

Bibliography

Basic:

