Guilherme Nuno Campos Góis

Bachelor

Sentiment Analysis on Product-Service Systems

Dissertation submitted in partial fulfillment
of the requirements for the degree of

Master of Science in
Electrical and Computer Engineering

Adviser: Rui Alexandre Nunes Neves da Silva, Full Professor,
NOVA University of Lisbon

Examination Committee

Chairperson:	Name of the committee chairperson
Raporteurs:	Name of a raporteur
	Name of another raporteur
Members:	Another member of the committee
	Yet another member of the committee

FACULDADE DE
CIÊNCIAS E TECNOLOGIA
UNIVERSIDADE NOVA DE LISBOA

DRAFT: March 3, 2018

Sentiment Analysis on Product-Service Systems

This document was created using the (pdf)LaTeX processor, based in the "novathesis" template[1], developed at the Dep. Informática of FCT-NOVA [2].
[1] https://github.com/joaomlourenco/novathesis [2] http://www.di.fct.unl.pt

Lorem ipsum.

Acknowledgements

The acknowledgements. You are free to write this section at your own will. However, usually it starts with the institutional acknowledgements (adviser, institution, grants, workmates, ...) and then comes the personal acknowledgements (friends, family, ...).

Abstract

The dissertation must contain two versions of the abstract, one in the same language as the main text, another in a different language. The package assumes that the two languages under consideration are always Portuguese and English.

The package will sort the abstracts in the appropriate order. This means that the first abstract will be in the same language as the main text, followed by the abstract in the other language, and then followed by the main text. For example, if the dissertation is written in Portuguese, first will come the summary in Portuguese and then in English, followed by the main text in Portuguese. If the dissertation is written in English, first will come the summary in English and then in Portuguese, followed by the main text in English.

The abstract shoul not exceed one page and should answer the following questions:

- What's the problem?
- Why is it interesting?
- What's the solution?
- What follows from the solution?

Keywords: Keywords (in English) ...

Resumo

Independentemente da língua em que está escrita a dissertação, é necessário um resumo na língua do texto principal e um resumo noutra língua. Assume-se que as duas línguas em questão serão sempre o Português e o Inglês.

O *template* colocará automaticamente em primeiro lugar o resumo na língua do texto principal e depois o resumo na outra língua. Por exemplo, se a dissertação está escrita em Português, primeiro aparecerá o resumo em Português, depois em Inglês, seguido do texto principal em Português. Se a dissertação está escrita em Inglês, primeiro aparecerá o resumo em Inglês, depois em Português, seguido do texto principal em Inglês.

O resumo não deve exceder uma página e deve responder às seguintes questões:

- Qual é o problema?
- Porque é que ele é interessante?
- Qual é a solução?
- O que resulta (implicações) da solução?

E agora vamos fazer um teste com uma quebra de linha no hífen a ver se a LaTeX duplica o hífen na linha seguinte...

zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz zzz zzzz comentar--lhe zzz zzzz zzz zzzz

Sim! Funciona! :)

Palavras-chave: Palavras-chave (em Português) ...

Contents

List of Figures

Chapter 1

State of the Art

1.1 Social Networks

Social Network Theory and Analysis, these are the area that study the currently emerging networks.
Network communication can be found all around us human bodies have them (Neves et al, 2008), physics, politics, computer science, etc. Socially, in later years, networks have been developed used many important websites like facebook, twitter, Instagram. This has created a new importunity for marketing and analysis. Since this work is mainly focused on feedback I'll focus more on that particular area.

Before defining different network types it's important to connect common definitions to social networks language.

- Nodes: In this case can be associated with Authors or Posts, may apply to a specific person or a post on social media depending if we are evaluating user network or posts networks

- Relations: This defines the tie between authors or posts. Ties where both nodes are related in the same way (eg. Two different authors commented on same post) are called undirected.

  Relationship when relation is different on both ends are considered directed. These connections can be one directional, an authors replying to a post from another author, or bi directional the reply to a post.

- Weighted Relations: Not all tie are alike, some nodes may have stronger connections while others might have a smaller impact between each other

- Network: The collection of authors and ties. When multiple networks are created and overlapped it becomes a Multiplex network. This evolved state is present in many social media, creating multiple and different relations between authors.

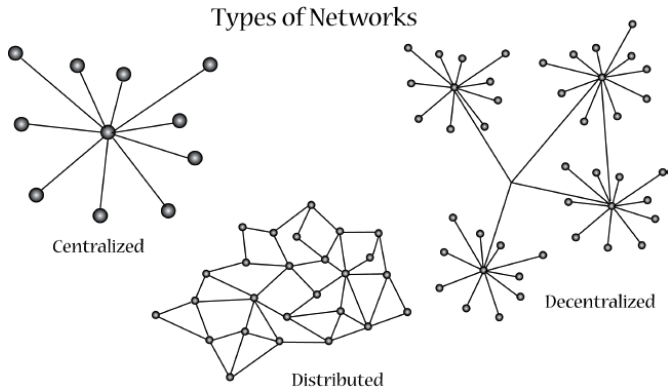

Figure 1.1: Network Types

Figure 2.1 shows some examples of network diagrams. Centralized networks are highly advantageous connection wise, everyone can give information to each other within 2 step, but fail when the centralized node is offline for some reason, this stops the entire network.

Before internet, companies had to rely on Decentralized networks to gather feedback, some still do. By decentralizing, the amount of nodes that fail when the upper node disappear is lower, although it still happens. The big advantage of this layout is that it can easily become a Distributed network. Outer and lower connection nodes can easily connect to each other and create redundancy.

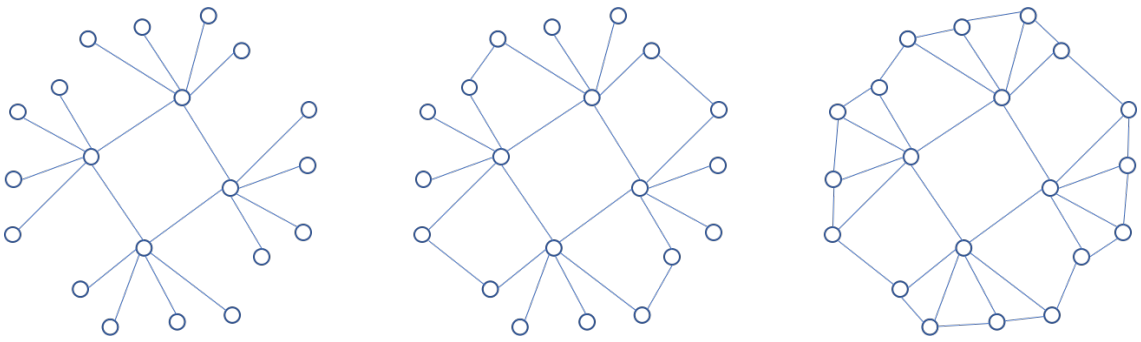

Figure 1.2: Decentralized to Distributed

Distributed networks, occur when initially isolated nodes start to make connections with other nodes, something like in facebook when a user starts adding friends-of-friends, or following a page instead of waiting for a friend to share information from said page Figure 2.2. This means that everyone has the same, or really close, importance in the network.A Layout like this is extremely utopic when thinking about feedback analysis.

While everyone has their own, valid, opinion on a product, people like celebrities can spread their opinion faster than a kindergartner. Realistically, decentralized networks are the most common occurrence.

1.2 Natural Language Processing

Chapter 2

State of the Art

2.1 Social Networks

Social Network Theory and Analysis, these are the area that study the currently emerging networks.
Network communication can be found all around us human bodies have them (Neves et al, 2008), physics, politics, computer science, etc. Socially, in later years, networks have been developed used many important websites like facebook, twitter, Instagram. This has created a new importunity for marketing and analysis. Since this work is mainly focused on feedback I'll focus more on that particular area.

Before defining different network types it's important to connect common definitions to social networks language.

- Nodes: In this case can be associated with Authors or Posts, may apply to a specific person or a post on social media depending if we are evaluating user network or posts networks

- Relations: This defines the tie between authors or posts. Ties where both nodes are related in the same way (eg. Two different authors commented on same post) are called undirected.

  Relationship when relation is different on both ends are considered directed. These connections can be one directional, an authors replying to a post from another author, or bi directional the reply to a post.

- Weighted Relations: Not all tie are alike, some nodes may have stronger connections while others might have a smaller impact between each other

- Network: The collection of authors and ties. When multiple networks are created and overlapped it becomes a Multiplex network. This evolved state is present in many social media, creating multiple and different relations between authors.

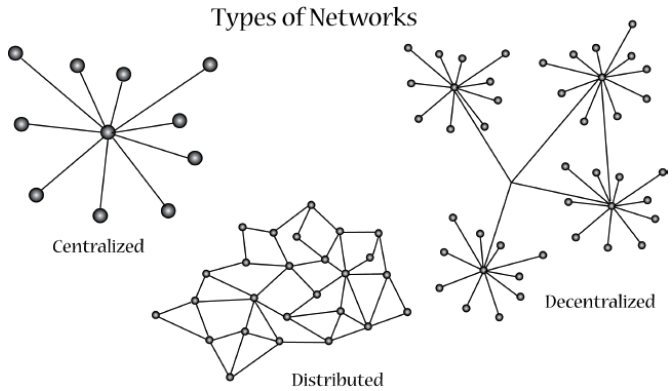

Figure 2.1: Network Types

Figure 2.1 shows some examples of network diagrams. Centralized networks are highly advantageous connection wise, everyone can give information to each other within 2 step, but fail when the centralized node is offline for some reason, this stops the entire network.

Before internet, companies had to rely on Decentralized networks to gather feedback, some still do. By decentralizing, the amount of nodes that fail when the upper node disappear is lower, although it still happens. The big advantage of this layout is that it can easily become a Distributed network. Outer and lower connection nodes can easily connect to each other and create redundancy.

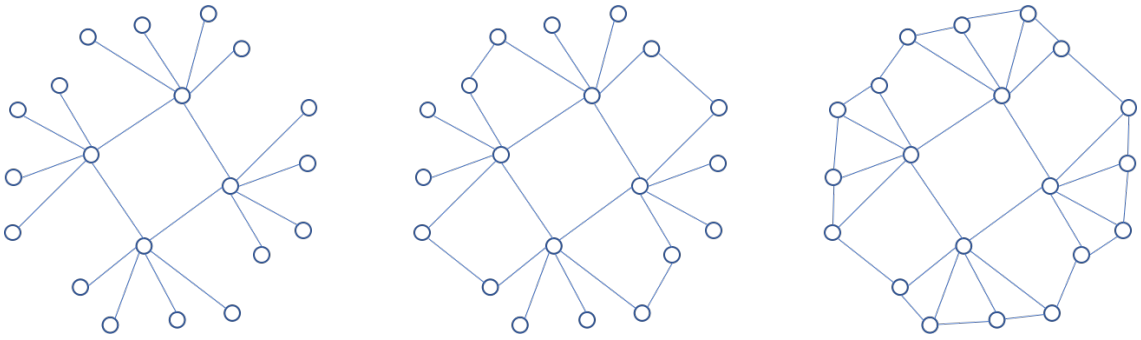

Figure 2.2: Decentralized to Distributed

Distributed networks, occur when initially isolated nodes start to make connections with other nodes, something like in facebook when a user starts adding friends-of-friends, or following a page instead of waiting for a friend to share information from said page Figure 2.2. This means that everyone has the same, or really close, importance in the network.A Layout like this is extremely utopic when thinking about feedback analysis.

While everyone has their own, valid, opinion on a product, people like celebrities can spread their opinion faster than a kindergartner. Realistically, decentralized networks are the most common occurrence.

2.2 Natural Language Processing