Technische Universität München

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Transfer Learning for Name Entity Linking with Deep Learning

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Robin Otto, Master Thesis – Kick-Off Presentation

Software Engineering für betriebliche Informationssysteme (sebis)
Fakultät für Informatik
Technische Universität München

wwwmatthes.in.tum.de

Structure

1. **Introduction**
2. Motivation
3. Important Concepts
4. Research Questions
5. Approach
6. Schedule

Introduction

Transfer Learning

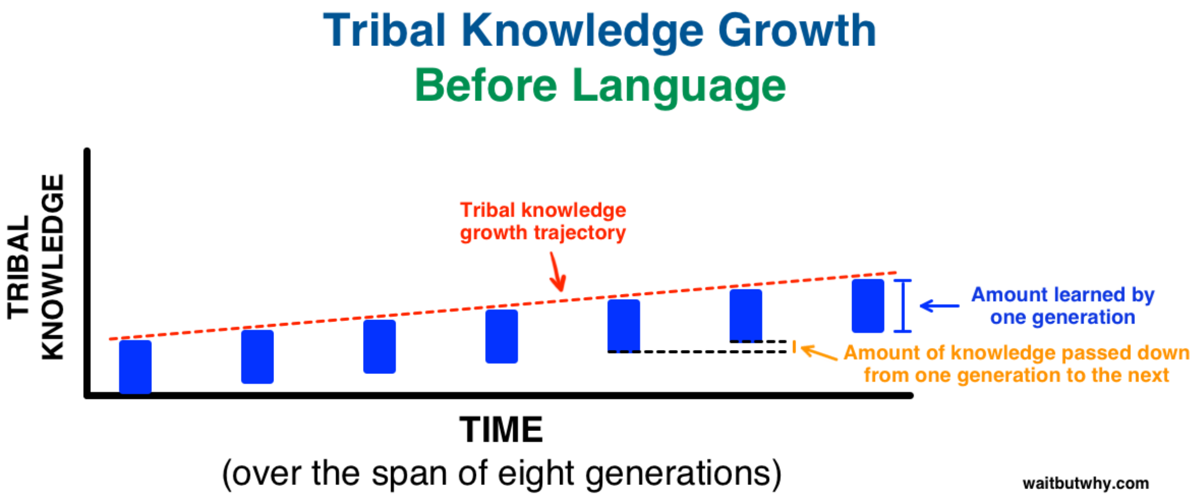
Instead of designing a neural network from scratch:

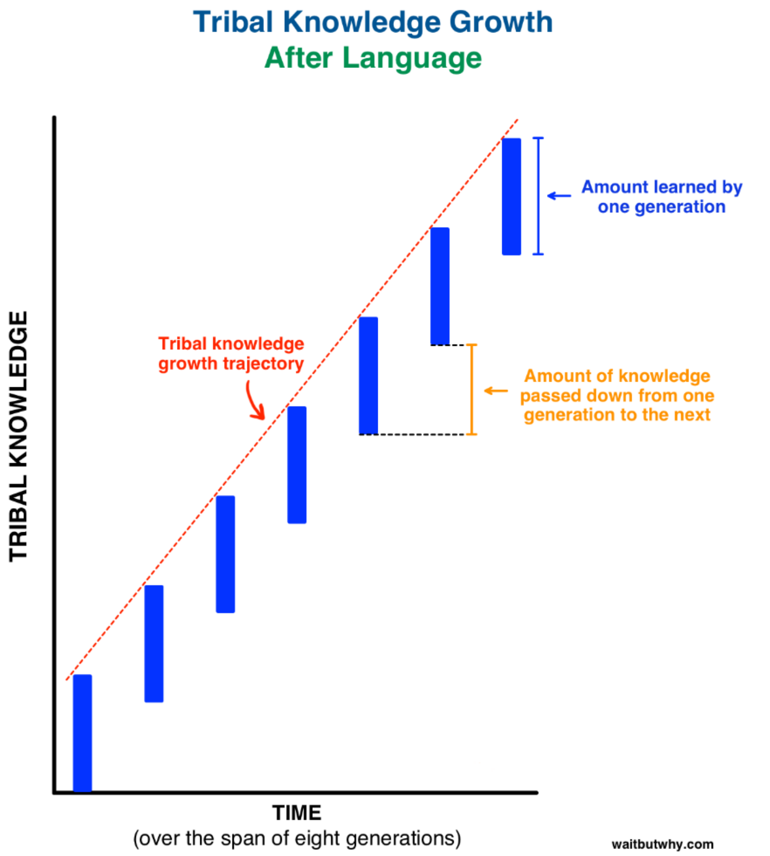
- Use pretrained network and apply it‘s weights and biases to a different domain
- Adapt the network for the specific target

→ Advantage (here compared to the invention of human language):

Transfer learned weights and biases from one system to another

to improve in terms of progress and efficiency





Structure

1.

Why Legal Domain?

- Engineers, lawyers etc. rely on its content

2.

Why Transfer Learning?

- Scarcity of data for specific use cases
  → Nearly impossible to implement a deep network from scratch
- Use of successful, available networks

3.

Why Named Entity Linking?

- Wording of legal documents often unclear and confusing for people from other domains
- Many stakeholders need to understand keywords from legal documents
  → Link keywords to their definitions for an improved reading experience

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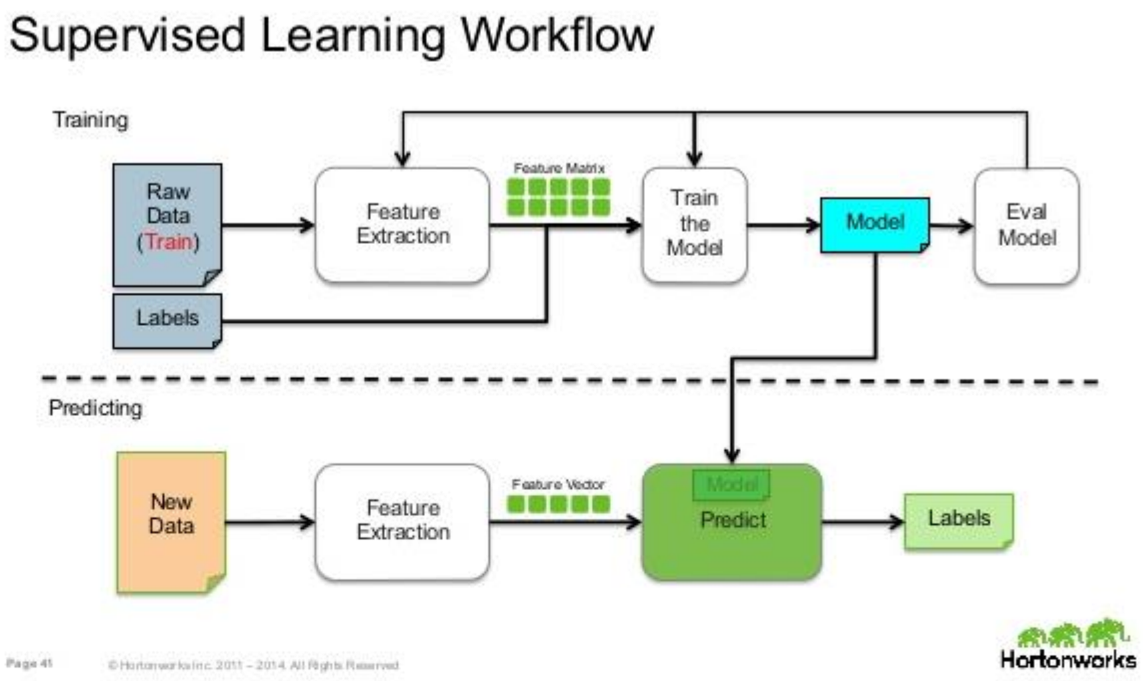
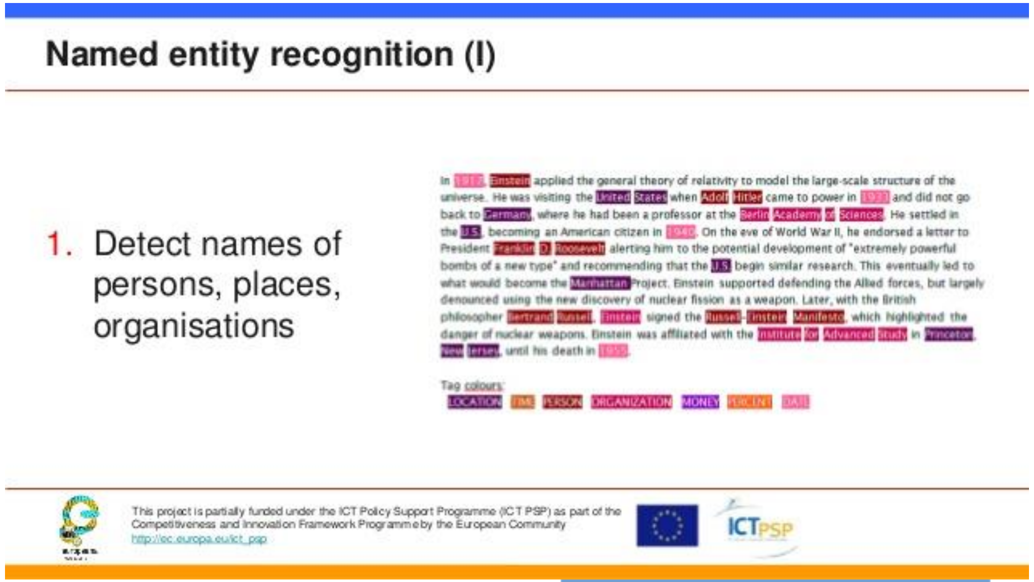
- Labeled and preprocessed training set
- Known inputs and outputs
- Network determines function to map input to output



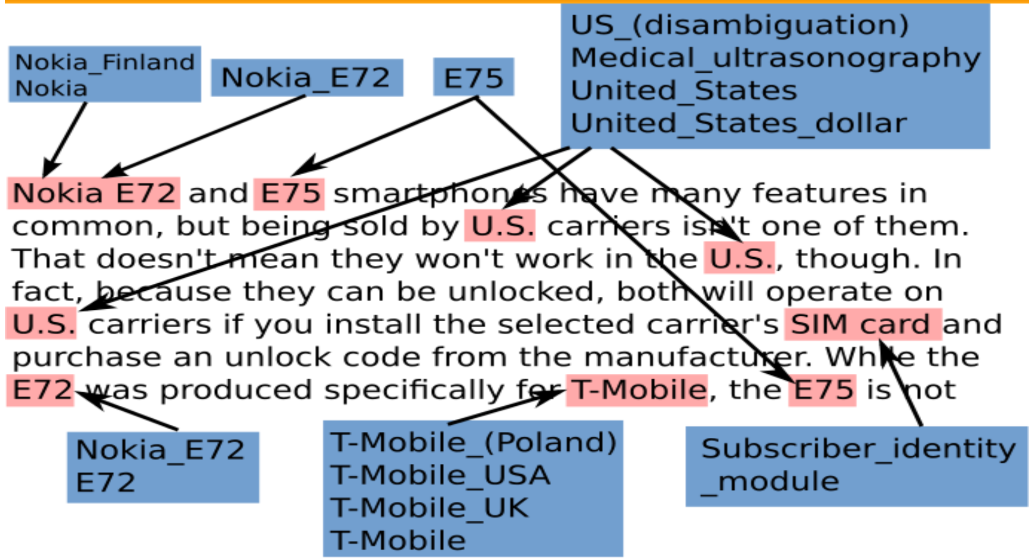
Important Concepts

Named Entity Linking

- Named Entity Recognition (NER)
  - Subtask of information extraction
  - Extract and cluster named entities from text into categories



- Named Entity Disambiguation (NED)
  - Connect a named-entity occurrence to a data-/knowledge-base
  - Mostly Wikipedia-derived (DBpedia)



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Research Questions

Transfer Learning & Neural Net Comparison

1. Is the use of Transfer Learning beneficial in the EU Regulation domain?

- Would a network with randomly initialized weights be better?
- Could other approaches lead to better results?

2. If so, which technique of Transfer Learning suits best?

- Use the pretrained network's weights, replace last layer
- Use the pretrained network's weights, append new trainable layers
- Use network weights as initial weights, train whole network, replace last layer

3. What algorithm should be used for Transfer Learning?

- Comparison needed with predefined criteria

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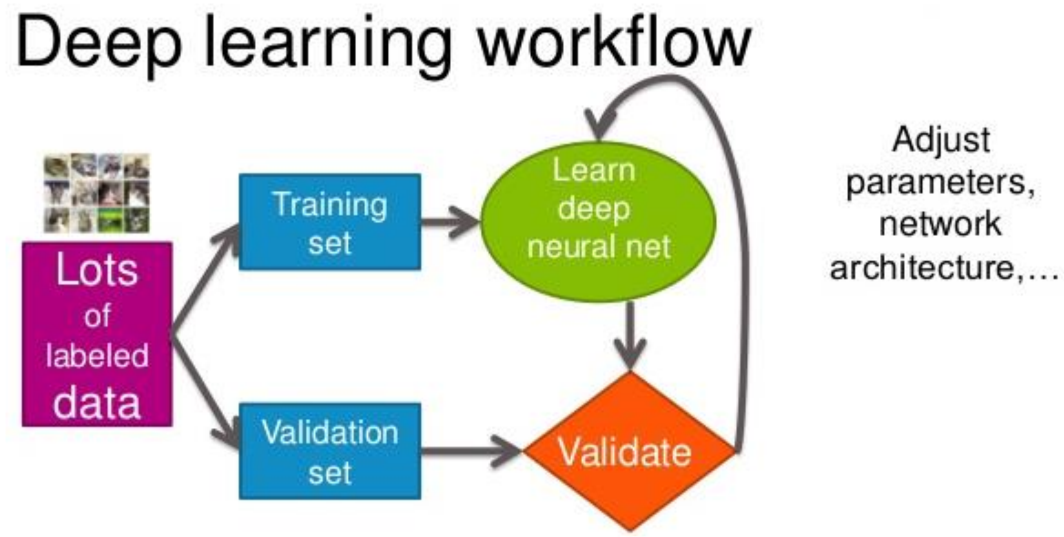
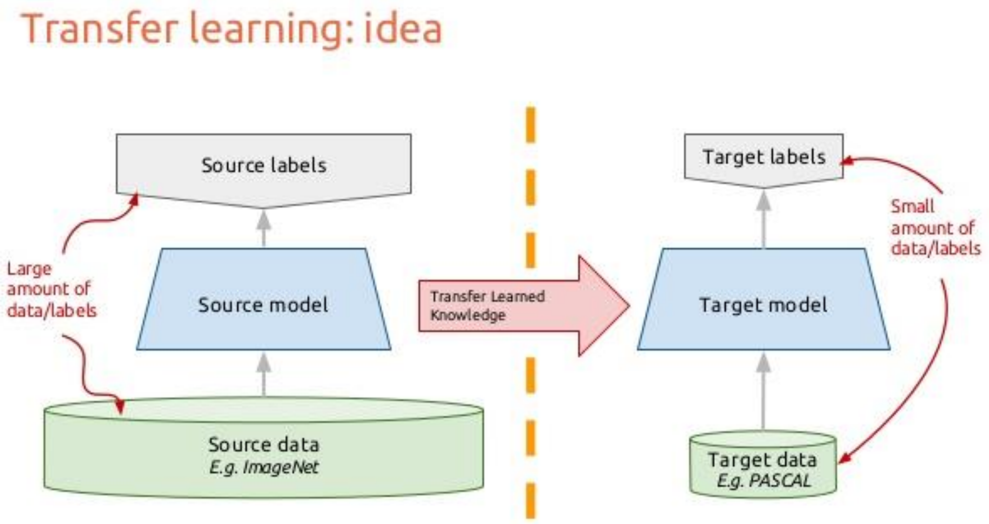
- Compare different pre-trained networks according to different criteria
  - E.g. based on speed, accuracy, etc.
  - Rank networks respectively
- Choose dedicated algorithm for the integration
- Big datasets used for transfer learning
  - Wikilinks
  - AIDA-CoNLL

- Apply Transfer Learning:
  Adapt pretrained algorithm to specific needs for private (smaller, unlabeled) datasets
- Here: Datasets from the legal domain that are going to be annotated by a bot. Topic: EU Regulation
- Test network and interpret results





Approach

Dataset annotation

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REGULATION (EU) 2017/1938 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 25 October 2017

concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 194(2) thereof,

Having regard to the proposal from the European Commission,

After transmission of the draft legislative act to the national parliaments,

Having regard to the opinion of the European Economic and Social Committee (1),

After consulting the Committee of the Regions,

Acting in accordance with the ordinary legislative procedure (2),

Whereas:

(1) Natural gas (gas) remains an essential component of the energy supply of the Union. A large proportion of such gas is imported into the Union from third countries.

(2) A major disruption of gas supply can affect all Member States, the Union and Contracting Parties to the Treaty establishing the Energy Community, signed in Athens on 25 October 2005. It can also severely damage the Union economy and can have a major social impact, in particular on vulnerable groups of customers.

(3) This Regulation aims to ensure that all the necessary measures are taken to safeguard an uninterrupted supply of gas throughout the Union, in particular to protected customers in the event of difficult climatic conditions or disruptions of the gas supply. Those objectives should be achieved through the most cost-effective measures and in such a way that gas markets are not distorted.

(4) Union law, in particular Directive 2009/72/EC of the European Parliament and of the Council (3), Directive 2009/73/EC of the European Parliament and of the Council (4), Regulation (EC) No 713/2009 of the European Parliament and of the Council (5), Regulation (EC) No 714/2009 of the European Parliament and of the Council (6), Regulation (EC) No 715/2009 of the European Parliament and of the Council (7) and Regulation (EU)No 994/2010 of the European Parliament and of the Council (8), has already had a significant positive impact on the security of gas supply in the Union, both in terms of preparation and mitigation. Member States are better prepared to face a supply crisis now that they are required to establish preventive action plans and emergency plans, and they are better protected now that they have to meet a number of obligations regarding infrastructure capacity and gas supply. However, the Commission's report on the implementation of Regulation (EU) No 994/2010 of October 2014 highlighted areas in which improvements to that Regulation could further bolster the security of gas supply in the Union.

Article 2

Definitions

For the purposes of this Regulation, the following definitions apply:

(1) 'security' means security as defined in point 32 of Article 2 of Directive 2009/73/EC;

(2) 'customer' means customer as defined in point 24 of Article 2 of Directive 2009/73/EC;

(3) 'household customer' means household customer as defined in point 25 of Article 2 of Directive 2009/73/EC;

(4) 'essential social service' means a service related to healthcare, essential social care, emergency, security, education or public administration;

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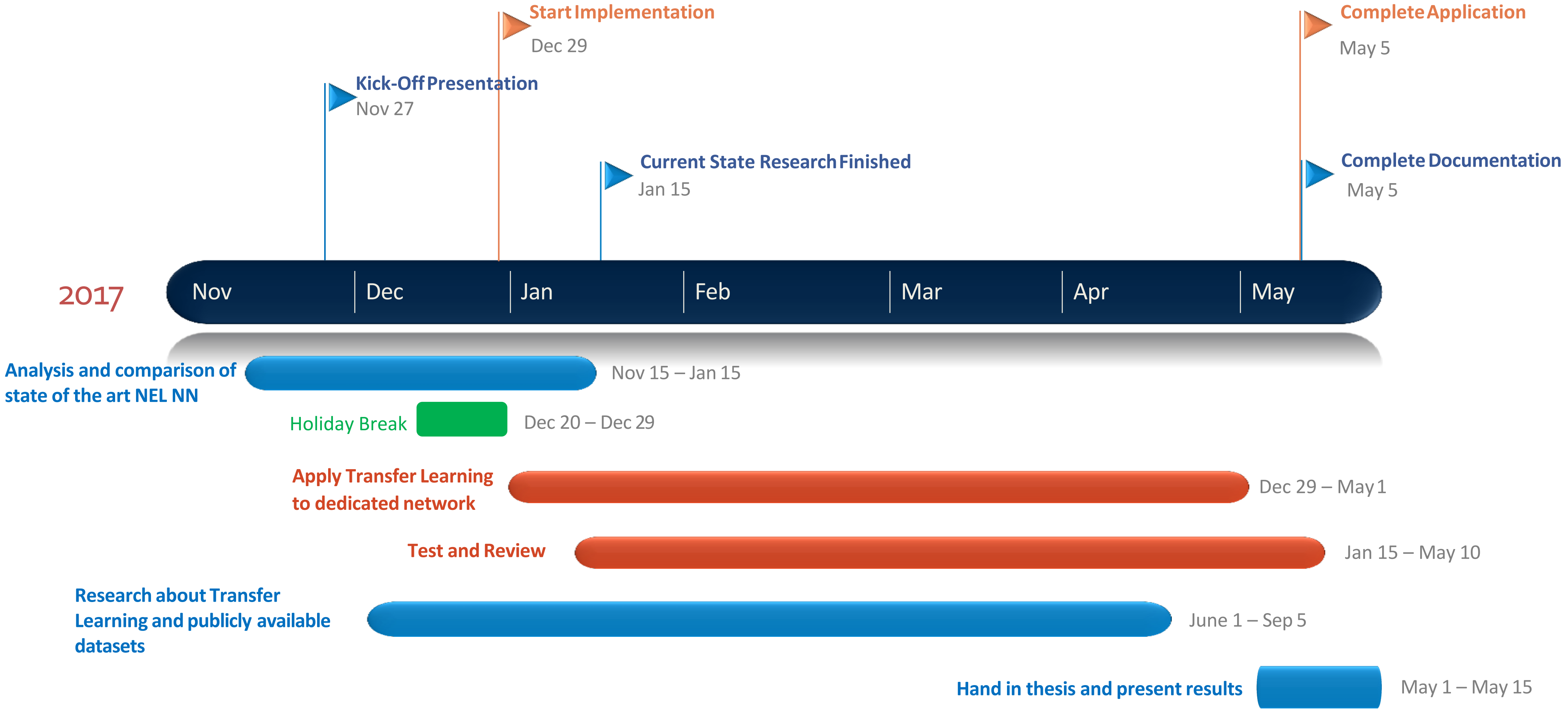

Start Implementation
Dec 29
Complete Application
May 5
Kick-Off Presentation
Nov 27
Current State Research Finished
Jan 15
Complete Documentation
May 5
2017
Nov
Dec
Jan
Feb
Mar
Apr
May
Analysis and comparison of state of the art NEL NN
Nov 15 – Jan 15
Holiday Break
Dec 20 – Dec 29
Apply Transfer Learning to dedicated network
Dec 29 – May 1
Test and Review
Jan 15 – May 10
Research about Transfer Learning and publicly available datasets
June 1 – Sep 5
Hand in thesis and present results
May 1 – May 15

Literature

Sources:

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- http://eur-lex.europa.eu/search.html?qid=1511170562653&DB_TYPE_OF_ACT=regulation&CASE_LAW_SUMMARY=false&DTS_DOM=ALL&excConsLeg=true&typeOfActStatus=REGULATION&type=advanced&SUBDOM_INIT=ALL_ALL&DTS_SUBDOM=ALL_ALL