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Spoken Dialogue Systems

Kristiina Jokinen
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*SYNTHESIS LECTURES ON
HUMAN LANGUAGE TECHNOLOGIES*

Græme Hirst, *Series Editor*

Spoken Dialogue Systems Michael Mctear

R Sandford



Spoken Dialogue Systems Michael Mctear:

Conversational AI Michael McTear, 2022-05-31 This book provides a comprehensive introduction to Conversational AI. While the idea of interacting with a computer using voice or text goes back a long way it is only in recent years that this idea has become a reality with the emergence of digital personal assistants, smart speakers and chatbots. Advances in AI, particularly in deep learning along with the availability of massive computing power and vast amounts of data have led to a new generation of dialogue systems and conversational interfaces. Current research in Conversational AI focuses mainly on the application of machine learning and statistical data driven approaches to the development of dialogue systems. However it is important to be aware of previous achievements in dialogue technology and to consider to what extent they might be relevant to current research and development. Three main approaches to the development of dialogue systems are reviewed: rule based systems that are handcrafted using best practice guidelines; statistical data driven systems based on machine learning; and neural dialogue systems based on end to end learning. Evaluating the performance and usability of dialogue systems has become an important topic in its own right and a variety of evaluation metrics and frameworks are described. Finally a number of challenges for future research are considered including multimodality in dialogue systems, visual dialogue, data efficient dialogue, model learning using knowledge graphs, discourse and dialogue phenomena, hybrid approaches to dialogue systems development, dialogue with social robots and in the Internet of Things, and social and ethical issues.

Spoken Dialogue Systems Kristina Jokinen, Michael McTear, 2022-05-31 Considerable progress has been made in recent years in the development of dialogue systems that support robust and efficient human machine interaction using spoken language. Spoken dialogue technology allows various interactive applications to be built and used for practical purposes and research focuses on issues that aim to increase the system's communicative competence by including aspects of error correction, cooperation, multimodality and adaptation in context. This book gives a comprehensive view of state of the art techniques that are used to build spoken dialogue systems. It provides an overview of the basic issues such as system architectures, various dialogue management methods, system evaluation and also surveys advanced topics concerning extensions of the basic model to more conversational setups. The goal of the book is to provide an introduction to the methods, problems and solutions that are used in dialogue system development and evaluation. It presents dialogue modelling and system development issues relevant in both academic and industrial environments and also discusses requirements and challenges for advanced interaction management and future research.

Table of Contents Preface Introduction to Spoken Dialogue Systems Dialogue Management Error Handling Case Studies Advanced Approaches to Dialogue Management Advanced Issues Methodologies and Practices of Evaluation Future Directions References Author Biographies

Spoken Dialogue Systems Technology and Design Wolfgang Minker, Gary Geunbae Lee, Satoshi Nakamura, Joseph Mariani, 2010-11-09 *Spoken Dialogue Systems Technology and Design* covers key topics in the field of spoken language dialogue interaction from

a variety of leading researchers It brings together several perspectives in the areas of corpus annotation and analysis dialogue system construction as well as theoretical perspectives on communicative intention context based generation and modelling of discourse structure These topics are all part of the general research and development within the area of discourse and dialogue with an emphasis on dialogue systems corpora and corpus tools and semantic and pragmatic modelling of discourse and dialogue Proceedings of the Paralinguistic Information and its Integration in Spoken Dialogue Systems Workshop Ramón López-Cózar Delgado,Tetsunori Kobayashi,2011-08-27 This volume includes proceedings articles presented at the Workshop on Paralinguistic Information and its Integration in Spoken Dialogue Systems held in Granada Spain The material focuses on the three broad areas of spoken dialogue systems for robotics emotions and spoken dialogue systems and Spoken dialogue systems for real world applications The workshop proceedings are part of the 3rd Annual International Workshop on Spoken Dialogue Systems which brings together researchers from all over the world working in the field of spoken dialogue systems It provides an international forum for the presentation of research and applications and for lively discussions among researchers as well as industrialists Spoken Dialogue Technology Michael F.

McTear,2004-09-09 Spoken Dialogue Technology provides extensive coverage of spoken dialogue systems ranging from the theoretical underpinnings of the study of dialogue through to a detailed look at a number of well established methods and tools for developing spoken dialogue systems The book enables students and practitioners to design and test dialogue systems using several available development environments and languages including the CSLU toolkit VoiceXML SALT and XHTML voice This practical orientation is usually available otherwise only in reference manuals supplied with software development kits The latest research in spoken dialogue systems is presented along with extensive coverage of the most relevant theoretical issues and a critical evaluation of current research prototypes A dedicated web site containing supplementary materials code links to resources will enable readers to develop and test their own systems Previously such materials have been difficult to track down available only on a range of disparate web sites and this web site provides a unique and useful reference source which will prove invaluable **Decision Theory Models for Applications in Artificial**

Intelligence: Concepts and Solutions Sucar, L. Enrique,Morales, Eduardo F.,Hoey, Jesse,2011-10-31 One of the goals of artificial intelligence AI is creating autonomous agents that must make decisions based on uncertain and incomplete information The goal is to design rational agents that must take the best action given the information available and their goals Decision Theory Models for Applications in Artificial Intelligence Concepts and Solutions provides an introduction to different types of decision theory techniques including MDPs POMDPs Influence Diagrams and Reinforcement Learning and illustrates their application in artificial intelligence This book provides insights into the advantages and challenges of using decision theory models for developing intelligent systems *Semi-Supervised Learning and Domain Adaptation in Natural Language Processing* Anders Søgaard,2022-05-31 This book introduces basic supervised learning algorithms applicable to

natural language processing NLP and shows how the performance of these algorithms can often be improved by exploiting the marginal distribution of large amounts of unlabeled data One reason for that is data sparsity i e the limited amounts of data we have available in NLP However in most real world NLP applications our labeled data is also heavily biased This book introduces extensions of supervised learning algorithms to cope with data sparsity and different kinds of sampling bias This book is intended to be both readable by first year students and interesting to the expert audience My intention was to introduce what is necessary to appreciate the major challenges we face in contemporary NLP related to data sparsity and sampling bias without wasting too much time on details about supervised learning algorithms or particular NLP applications I use text classification part of speech tagging and dependency parsing as running examples and limit myself to a small set of cardinal learning algorithms I have worried less about theoretical guarantees this algorithm never does too badly than about useful rules of thumb in this case this algorithm may perform really well In NLP data is so noisy biased and non stationary that few theoretical guarantees can be established and we are typically left with our gut feelings and a catalogue of crazy ideas I hope this book will provide its readers with both Throughout the book we include snippets of Python code and empirical evaluations when relevant

Automated Essay Scoring Beata Beigman Klebanov,Nitin Madnani,2022-05-31 This book discusses the state of the art of automated essay scoring its challenges and its potential One of the earliest applications of artificial intelligence to language data along with machine translation and speech recognition automated essay scoring has evolved to become both a revenue generating industry and a vast field of research with many subfields and connections to other NLP tasks In this book we review the developments in this field against the backdrop of Elias Page s seminal 1966 paper titled The Imminence of Grading Essays by Computer Part 1 establishes what automated essay scoring is about why it exists where the technology stands and what are some of the main issues In Part 2 the book presents guided exercises to illustrate how one would go about building and evaluating a simple automated scoring system while Part 3 offers readers a survey of the literature on different types of scoring models the aspects of essay quality studied in prior research and the implementation and evaluation of a scoring engine Part 4 offers a broader view of the field inclusive of some neighboring areas and Part ref part5 closes with summary and discussion This book grew out of a week long course on automated evaluation of language production at the North American Summer School for Logic Language and Information NASSLLI attended by advanced undergraduates and early stage graduate students from a variety of disciplines Teachers of natural language processing in particular will find that the book offers a useful foundation for a supplemental module on automated scoring Professionals and students in linguistics applied linguistics educational technology and other related disciplines will also find the material here useful

Metaphor Tony Veale,Ekaterina Shutova,Beata Beigman Klebanov,2022-06-01 The literary imagination may take flight on the wings of metaphor but hard headed scientists are just as likely as doe eyed poets to reach for a metaphor when the descriptive need arises Metaphor is a pervasive aspect of every genre of text and every

register of speech and is as useful for describing the inner workings of a black hole itself a metaphor as it is the affairs of the human heart The ubiquity of metaphor in natural language thus poses a significant challenge for Natural Language Processing NLP systems and their builders who cannot afford to wait until the problems of literal language have been solved before turning their attention to figurative phenomena This book offers a comprehensive approach to the computational treatment of metaphor and its figurative brethren including simile analogy and conceptual blending that does not shy away from their important cognitive and philosophical dimensions Veale Shutova and Beigman Klebanov approach metaphor from multiple computational perspectives providing coverage of both symbolic and statistical approaches to interpretation and paraphrase generation while also considering key contributions from philosophy on what constitutes the meaning of a metaphor This book also surveys available metaphor corpora and discusses protocols for metaphor annotation Any reader with an interest in metaphor from beginning researchers to seasoned scholars will find this book to be an invaluable guide to what is a fascinating linguistic phenomenon

Argumentation Mining Manfred Stede, Jodi Schneider, 2022-06-01

Argumentation mining is an application of natural language processing NLP that emerged a few years ago and has recently enjoyed considerable popularity as demonstrated by a series of international workshops and by a rising number of publications at the major conferences and journals of the field Its goals are to identify argumentation in text or dialogue to construct representations of the constellation of claims supporting and attacking moves in different levels of detail and to characterize the patterns of reasoning that appear to license the argumentation Furthermore recent work also addresses the difficult tasks of evaluating the persuasiveness and quality of arguments Some of the linguistic genres that are being studied include legal text student essays political discourse and debate newspaper editorials scientific writing and others The book starts with a discussion of the linguistic perspective characteristics of argumentative language and their relationship to certain other notions such as subjectivity Besides the connection to linguistics argumentation has for a long time been a topic in Artificial Intelligence where the focus is on devising adequate representations and reasoning formalisms that capture the properties of argumentative exchange It is generally very difficult to connect the two realms of reasoning and text analysis but we are convinced that it should be attempted in the long term and therefore we also touch upon some fundamentals of reasoning approaches Then the book turns to its focus the computational side of mining argumentation in text We first introduce a number of annotated corpora that have been used in the research From the NLP perspective argumentation mining shares subtasks with research fields such as subjectivity and sentiment analysis semantic relation extraction and discourse parsing Therefore many technical approaches are being borrowed from those and other fields We break argumentation mining into a series of subtasks starting with the preparatory steps of classifying text as argumentative or not and segmenting it into elementary units Then central steps are the automatic identification of claims and finding statements that support or oppose the claim For certain applications it is also of interest to compute a full structure of an argumentative

constellation of statements Next we discuss a few steps that try to dig deeper to infer the underlying reasoning pattern for a textual argument to reconstruct unstated premises so called enthymemes and to evaluate the quality of the argumentation We also take a brief look at the other side of mining i e the generation or synthesis of argumentative text The book finishes with a summary of the argumentation mining tasks a sketch of potential applications and a necessarily subjective outlook for the field

Cross-Lingual Word Embeddings Anders Søgaard,Ivan Vulić,Sebastian Ruder,Manaal Faruqi,2022-05-31

The majority of natural language processing NLP is English language processing and while there is good language technology support for standard varieties of English support for Albanian Burmese or Cebuano and most other languages remains limited Being able to bridge this digital divide is important for scientific and democratic reasons but also represents an enormous growth potential A key challenge for this to happen is learning to align basic meaning bearing units of different languages In this book the authors survey and discuss recent and historical work on supervised and unsupervised learning of such alignments Specifically the book focuses on so called cross lingual word embeddings The survey is intended to be systematic using consistent notation and putting the available methods on comparable form making it easy to compare wildly different approaches In so doing the authors establish previously unreported relations between these methods and are able to present a fast growing literature in a very compact way Furthermore the authors discuss how best to evaluate cross lingual word embedding methods and survey the resources available for students and researchers interested in this topic

Linguistic Fundamentals for Natural Language Processing Emily M. Bender,2022-05-31 Many NLP tasks have at their core a subtask of extracting the dependencies who did what to whom from natural language sentences This task can be understood as the inverse of the problem solved in different ways by diverse human languages namely how to indicate the relationship between different parts of a sentence Understanding how languages solve the problem can be extremely useful in both feature design and error analysis in the application of machine learning to NLP Likewise understanding cross linguistic variation can be important for the design of MT systems and other multilingual applications The purpose of this book is to present in a succinct and accessible fashion information about the morphological and syntactic structure of human languages that can be useful in creating more linguistically sophisticated more language independent and thus more successful NLP systems Table of Contents Acknowledgments Introduction motivation Morphology Introduction Morphophonology Morphosyntax Syntax Introduction Parts of speech Heads arguments and adjuncts Argument types and grammatical functions Mismatches between syntactic position and semantic roles Resources Bibliography Author s Biography General Index Index of Languages

Quality Estimation for Machine Translation Lucia Specia,Carolina Scarton,Gustavo Henrique Paetzold,2022-05-31 Many applications within natural language processing involve performing text to text transformations i e given a text in natural language as input systems are required to produce a version of this text e g a translation also in natural language as output Automatically evaluating the output of such systems is an important

component in developing text to text applications Two approaches have been proposed for this problem i to compare the system outputs against one or more reference outputs using string matching based evaluation metrics and ii to build models based on human feedback to predict the quality of system outputs without reference texts Despite their popularity reference based evaluation metrics are faced with the challenge that multiple good and bad quality outputs can be produced by text to text approaches for the same input This variation is very hard to capture even with multiple reference texts In addition reference based metrics cannot be used in production e g online machine translation systems when systems are expected to produce outputs for any unseen input In this book we focus on the second set of metrics so called Quality Estimation QE metrics where the goal is to provide an estimate on how good or reliable the texts produced by an application are without access to gold standard outputs QE enables different types of evaluation that can target different types of users and applications Machine learning techniques are used to build QE models with various types of quality labels and explicit features or learnt representations which can then predict the quality of unseen system outputs This book describes the topic of QE for text to text applications covering quality labels features algorithms evaluation uses and state of the art approaches It focuses on machine translation as application since this represents most of the QE work done to date It also briefly describes QE for several other applications including text simplification text summarization grammatical error correction and natural language generation

Recognizing Textual Entailment Ido Dagan,Dan Roth,Fabio Zanzotto,Mark Sammons,2022-06-01 In the last few years a number of NLP researchers have developed and participated in the task of Recognizing Textual Entailment RTE This task encapsulates Natural Language Understanding capabilities within a very simple interface recognizing when the meaning of a text snippet is contained in the meaning of a second piece of text This simple abstraction of an exceedingly complex problem has broad appeal partly because it can be conceived also as a component in other NLP applications from Machine Translation to Semantic Search to Information Extraction It also avoids commitment to any specific meaning representation and reasoning framework broadening its appeal within the research community This level of abstraction also facilitates evaluation a crucial component of any technological advancement program This book explains the RTE task formulation adopted by the NLP research community and gives a clear overview of research in this area It draws out commonalities in this research detailing the intuitions behind dominant approaches and their theoretical underpinnings This book has been written with a wide audience in mind but is intended to inform all readers about the state of the art in this fascinating field to give a clear understanding of the principles underlying RTE research to date and to highlight the short and long term research goals that will advance this technology

Natural Language Processing for Social Media Atefeh Farzindar,2022-11-10 In recent years online social networking has revolutionized interpersonal communication The newer research on language analysis in social media has been increasingly focusing on the latter s impact on our daily lives both on a personal and a professional level Natural language processing NLP is one of the

most promising avenues for social media data processing It is a scientific challenge to develop powerful methods and algorithms which extract relevant information from a large volume of data coming from multiple sources and languages in various formats or in free form We discuss the challenges in analyzing social media texts in contrast with traditional documents Research methods in information extraction automatic categorization and clustering automatic summarization and indexing and statistical machine translation need to be adapted to a new kind of data This book reviews the current research on Natural Language Processing NLP tools and methods for processing the non traditional information from social media data that is available in large amounts big data and shows how innovative NLP approaches can integrate appropriate linguistic information in various fields such as social media monitoring health care business intelligence industry marketing and security and defense We review the existing evaluation metrics for NLP and social media applications and the new efforts in evaluation campaigns or shared tasks on new datasets collected from social media Such tasks are organized by the Association for Computational Linguistics such as SemEval tasks or by the National Institute of Standards and Technology via the Text REtrieval Conference TREC and the Text Analysis Conference TAC In the concluding chapter we discuss the importance of this dynamic discipline and its great potential for NLP in the coming decade in the context of changes in mobile technology cloud computing and social networking

Discourse Processing Manfred Stede, 2022-06-01 Discourse Processing here is framed as marking up a text with structural descriptions on several levels which can serve to support many language processing or text mining tasks We first explore some ways of assigning structure on the document level the logical document structure as determined by the layout of the text its genre specific content structure and its breakdown into topical segments Then the focus moves to phenomena of local coherence We introduce the problem of coreference and look at methods for building chains of coreferring entities in the text Next the notion of coherence relation is introduced as the second important factor of local coherence We study the role of connectives and other means of signaling such relations in text and then return to the level of larger textual units where tree or graph structures can be ascribed by recursively assigning coherence relations Taken together these descriptions can inform text summarization information extraction discourse aware sentiment analysis question answering and the like

Table of Contents Introduction Large Discourse Units and Topics Coreference Resolution Small Discourse Units and Coherence Relations Summary Text Structure on Multiple Interacting Levels

Sentiment Analysis and Opinion Mining Bing Liu, 2022-05-31 Sentiment analysis and opinion mining is the field of study that analyzes people s opinions sentiments evaluations attitudes and emotions from written language It is one of the most active research areas in natural language processing and is also widely studied in data mining Web mining and text mining In fact this research has spread outside of computer science to the management sciences and social sciences due to its importance to business and society as a whole The growing importance of sentiment analysis coincides with the growth of social media such as reviews forum discussions blogs micro blogs Twitter and social networks For the first time in

human history we now have a huge volume of opinionated data recorded in digital form for analysis Sentiment analysis systems are being applied in almost every business and social domain because opinions are central to almost all human activities and are key influencers of our behaviors Our beliefs and perceptions of reality and the choices we make are largely conditioned on how others see and evaluate the world For this reason when we need to make a decision we often seek out the opinions of others This is true not only for individuals but also for organizations This book is a comprehensive introductory and survey text It covers all important topics and the latest developments in the field with over 400 references It is suitable for students researchers and practitioners who are interested in social media analysis in general and sentiment analysis in particular Lecturers can readily use it in class for courses on natural language processing social media analysis text mining and data mining Lecture slides are also available online Table of Contents Preface Sentiment Analysis A Fascinating Problem The Problem of Sentiment Analysis Document Sentiment Classification Sentence Subjectivity and Sentiment Classification Aspect Based Sentiment Analysis Sentiment Lexicon Generation Opinion Summarization Analysis of Comparative Opinions Opinion Search and Retrieval Opinion Spam Detection Quality of Reviews Concluding Remarks Bibliography Author Biography Computational Modeling of Narrative Inderjeet Mani, 2022-05-31 The field of narrative or story understanding and generation is one of the oldest in natural language processing NLP and artificial intelligence AI which is hardly surprising since storytelling is such a fundamental and familiar intellectual and social activity In recent years the demands of interactive entertainment and interest in the creation of engaging narratives with life like characters have provided a fresh impetus to this field This book provides an overview of the principal problems approaches and challenges faced today in modeling the narrative structure of stories The book introduces classical narratological concepts from literary theory and their mapping to computational approaches It demonstrates how research in AI and NLP has modeled character goals causality and time using formalisms from planning case based reasoning and temporal reasoning and discusses fundamental limitations in such approaches It proposes new representations for embedded narratives and fictional entities for assessing the pace of a narrative and offers an empirical theory of audience response These notions are incorporated into an annotation scheme called NarrativeML The book identifies key issues that need to be addressed including annotation methods for long literary narratives the representation of modality and habituality and characterizing the goals of narrators It also suggests a future characterized by advanced text mining of narrative structure from large scale corpora and the development of a variety of useful authoring aids This is the first book to provide a systematic foundation that integrates together narratology AI and computational linguistics It can serve as a narratology primer for computer scientists and an elucidation of computational narratology for literary theorists It is written in a highly accessible manner and is intended for use by a broad scientific audience that includes linguists computational and formal semanticists AI researchers cognitive scientists computer scientists game developers and narrative theorists Table of Contents List of Figures List of Tables

Narratological Background Characters as Intentional Agents Time Plot Summary and Future Directions *Semantic Relations Between Nominals, Second Edition* Vivi Nastase, Stan Szpakowicz, Preslav Nakov, Diarmuid Ó Séaghdha, 2022-05-31

Opportunity and Curiosity find similar rocks on Mars One can generally understand this statement if one knows that Opportunity and Curiosity are instances of the class of Mars rovers and recognizes that as signalled by the word on rocks are located on Mars Two mental operations contribute to understanding recognize how entities concepts mentioned in a text interact and recall already known facts which often themselves consist of relations between entities concepts Concept interactions one identifies in the text can be added to the repository of known facts and aid the processing of future texts The amassed knowledge can assist many advanced language processing tasks including summarization question answering and machine translation Semantic relations are the connections we perceive between things which interact The book explores two now intertwined threads in semantic relations how they are expressed in texts and what role they play in knowledge repositories A historical perspective takes us back more than 2000 years to their beginnings and then to developments much closer to our time various attempts at producing lists of semantic relations necessary and sufficient to express the interaction between entities concepts A look at relations outside context then in general texts and then in texts in specialized domains has gradually brought new insights and led to essential adjustments in how the relations are seen At the same time datasets which encompass these phenomena have become available They started small then grew somewhat then became truly large The large resources are inevitably noisy because they are constructed automatically The available corpora to be analyzed or used to gather relational evidence have also grown and some systems now operate at the Web scale The learning of semantic relations has proceeded in parallel in adherence to supervised unsupervised or distantly supervised paradigms Detailed analyses of annotated datasets in supervised learning have granted insights useful in developing unsupervised and distantly supervised methods These in turn have contributed to the understanding of what relations are and how to find them and that has led to methods scalable to Web sized textual data The size and redundancy of information in very large corpora which at first seemed problematic have been harnessed to improve the process of relation extraction learning The newest technology deep learning supplies innovative and surprising solutions to a variety of problems in relation learning This book aims to paint a big picture and to offer interesting details **Statistical Methods for Annotation Analysis** Silviu Paun, Ron Artstein, Massimo Poesio, 2022-05-31

Labelling data is one of the most fundamental activities in science and has underpinned practice particularly in medicine for decades as well as research in corpus linguistics since at least the development of the Brown corpus With the shift towards Machine Learning in Artificial Intelligence AI the creation of datasets to be used for training and evaluating AI systems also known in AI as corpora has become a central activity in the field as well Early AI datasets were created on an ad hoc basis to tackle specific problems As larger and more reusable datasets were created requiring greater investment the need for a more systematic approach to dataset creation arose to ensure increased quality A

range of statistical methods were adopted often but not exclusively from the medical sciences to ensure that the labels used were not subjective or to choose among different labels provided by the coders A wide variety of such methods is now in regular use This book is meant to provide a survey of the most widely used among these statistical methods supporting annotation practice As far as the authors know this is the first book attempting to cover the two families of methods in wider use The first family of methods is concerned with the development of labelling schemes and in particular ensuring that such schemes are such that sufficient agreement can be observed among the coders The second family includes methods developed to analyze the output of coders once the scheme has been agreed upon particularly although not exclusively to identify the most likely label for an item among those provided by the coders The focus of this book is primarily on Natural Language Processing the area of AI devoted to the development of models of language interpretation and production but many if not most of the methods discussed here are also applicable to other areas of AI or indeed to other areas of Data Science

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