Preface

Natural language interpretation (NLI) can be modelled analogously to Bayesian signal processing: the most probable message M (corresponding to the speaker's intention) conveyed by a signal S (a word, a sentence, turn or text) is found by two models, namely the prior probability of the message and the production probability of the signal. From these models and Bayes' theorem, the most probable message given the signal can be derived. Although the general capacity of Bayesian models has been proven in disciplines like artificial intelligence, cognitive science, computational linguistics and signal processing, they are not yet common in NLI.

Bayesian NLI gives three departures from standard assumptions. First, it can be seen as a defence of linguistic semantics as a production system that maps meanings into forms as was assumed in generative semantics, but also in systemic grammar, functional grammar and optimality theoretic syntax. This brings with it a more relaxed view of the relation between syntactic and semantic structures; the mapping from meanings to forms should be efficient (linear) and the prior strong enough to find the inversion from the cues in the utterance.

The second departure is that the prior is also the source for what is not said in the utterance but part of the pragmatic enrichment of the utterance: what is part of the speaker intention but not of the literal meaning. There is no principled difference between inferring in perception that the man who is running in the direction of the bus stop as the bus is approaching is trying to catch the bus and inferring in conversation that the man who states that he is out of petrol is asking for help with his problem.

The third departure is thus that interpretation is viewed as a stochastic and holistic process leading from stochastic data to a symbolic representation or a probability distribution over such representations that can be equated with the conversational contribution of the utterance.

Models relevant to the prior (the probability of the message M) include Bayesian networks for causality, association between concepts and (common ground) expectations. It is tempting to see a division in logic: classical logic for expressing the message, the logic of uncertainty for finding out what those messages are. Radical Bayesian interpretation can be described as the view that not just the

identification of the message requires Bayesian methods, but also the message itself and the contextual update have to be interpreted with reference to Bayesian belief revision, Bayesian networks or conceptual association.

The papers in this volume, which is one of the first on Bayesian NLI, approach the topic from diverse angles. The following gives some minimal guidance with respect to the content of the papers.

- Henk Zeevat: "Perspectives on Bayesian Natural Language Semantics and Pragmatics" Zeevat gives an overview of the different concepts of Bayesian interpretation and some possible applications and open issues. This paper can be read as an introduction to Bayesian NL Interpretation.
- Anton Benz: "Causal Bayesian Networks, Signalling Games and Implicature of '*More Than n*'". Benz applies Causal Bayesian Nets and signalling games to explain the empirical data on implicatures arising from 'more than n' by modelling the speaker with these nets.
- Satoru Suzuki: "Measurement-Theoretic Foundations of Logic for Better Questions and Answers" The paper is concerned with finding a qualitative model of reasoning about optimal questions and makes a promising proposal. It is part of a wider programme to find qualitative models of other reasoning tasks that are normally approached by numerical equations like the stochastic reasoning in Bayesian interpretation.
- Stefan Kaufmann: "Conditionals, Conditional Probabilities, and Conditionalization" Kaufman gives a logical analysis of the relation between the probability of a conditional and the corresponding conditional probability, proposing Bayes' theorem as the link.
- Christian Wurm: "On the Probabilistic Notion of Causality: Models and Metalanguages" Wurm addresses the well-known problem of the reversibility of Bayesian nets. Nets can be turned into equally other nets by reversing all the arrows.
- Mathias Winther Madsen: "Shannon Versus Chomsky: Brain Potentials and the Syntax-Semantics Distinction" Based on a large number of existing experimental results, Madsen argues for a simple information theoretic hypothesis about the correlates of N400 and P600 effects in which an N400 is the sign of a temporary loss of hypotheses and a P600 the sign of too many hypotheses. This information theoretic approach has a strong relation with incremental Bayesian interpretation.
- Jacques Jayez: "Orthogonality and Presuppositions: A Bayesian Perspective" Jayez gives a direct application of Bayesian interpretation to the differential behaviour of various presupposition triggers in allowing presupposition suspension.
- Grégoire Winterstein: "Layered Meanings and Bayesian Argumentation: The Case of Exclusives" Winterstein applies a Bayesian theory of argumentation to the analysis of exclusive particles like "only".
- Ciyang Qing and Michael Franke: "Variations on a Bayesian Theme: Comparing Bayesian Models of Referential Reasoning" Inspired by game-theoretical

pragmatics, Qing and Franke propose a series of improvements to the RSA model of Goodman and Frank with the aim of improving its predictive power.

- Peter R. Sutton: "Towards a Probabilistic Semantics for Vague Adjectives" Sutton formalises and defends a nominalist approach to vague predicates in situation theory in which Bayesian learning is directly responsible for learning the use and interpretation of such predicates without an intervening logical representation.

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