

Compositional Translation: A Novel LLM-based Approach for Low-resource Machine Translation

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Abstract

The ability of generative large language models (LLMs) to perform in-context learning has given rise to a large body of research into how best to prompt models for various natural language processing tasks. Machine Translation (MT) has been shown to benefit from in-context examples, in particular when they are semantically similar to the sentence to translate. In this paper, we propose a new LLM-based translation paradigm, *compositional translation*, to replace naive few-shot MT with similarity-based demonstrations. An LLM is used to decompose a sentence into simpler phrases, and then to translate each phrase with the help of retrieved demonstrations. Finally, the LLM is prompted to translate the initial sentence with the help of the self-generated phrase-translation pairs. Our intuition is that this approach should improve translation because these shorter phrases should be intrinsically easier to translate and easier to match with relevant examples. This is especially beneficial in low-resource scenarios, and more generally whenever the selection pool is small or out of domain. We show that *compositional translation* boosts LLM translation performance on a wide range of popular MT benchmarks, including FLORES 200, NTREX 128 and TICO-19. Code and outputs are available at <https://github.com/ArmelRandy/compositional-translation>.

1. Introduction

Large Language Models (LLMs) have demonstrated strong performance across a wide variety of tasks (Chowdhery et al., 2023; Dubey et al., 2024). They use In-Context Learning (ICL; Brown et al., 2020) to solve problems at inference with the help of a few examples within their context. Multi-

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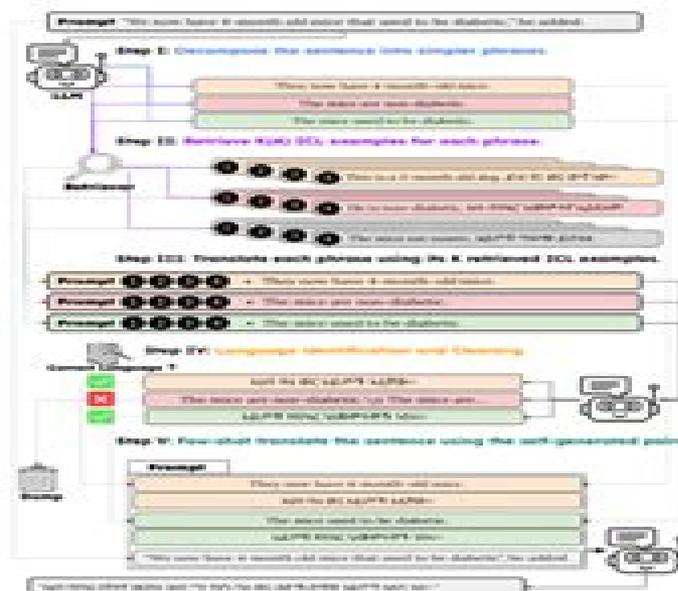


Figure 1. An overview of **Compositional Translation (CompTra)**. Given a sentence, our method prompts the LLM to decompose it into several phrases that use its words. For each phrase, we retrieve relevant in-context demonstrations (here four) through similarity search and use them to translate it in a few-shot setup. The phrase-translation couples obtained are then cleaned and provided to the LLM to help it translate the main sentence.

ple strategies have been introduced to expand the range of complexity of problems that can be addressed using ICL, with a particular emphasis on reasoning tasks (Wei et al., 2022; Kojima et al., 2022; Yao et al., 2023). In machine translation (MT), most works have focused on choosing the best in-context examples. The prevailing intuition is to choose them based on their word-level similarity to the

Compositional Translation

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Compositional Translation M.T. Rosetta,2013-12-01 This book provides an in depth review of machine translation by discussing in detail a particular method called compositional translation and a particular system Rosetta which is based on this method The Rosetta project is a unique combination of fundamental research and large scale implementation The book covers all scientifically interesting results of the project highlighting the advantages of designing a translation system based on a relation between reversible compositional grammars The power of the method is illustrated by presenting elegant solutions to a number of well known translation problems The most outstanding characteristic of the book is that it provides a firm linguistic foundation for machine translation For this purpose insights from Montague Grammar are integrated with ideas developed within the Chomskyan tradition in a computationally feasible framework Great care has been taken to introduce the basic concepts of the underlying disciplines to the uninitiated reader which makes the book accessible to a wide audience including linguists computer scientists logicians and translators Comparable Corpora and Computer-assisted Translation Estelle Maryline Delpech,2014-07-22 Computer assisted translation CAT has always used translation memories which require the translator to have a corpus of previous translations that the CAT software can use to generate bilingual lexicons This can be problematic when the translator does not have such a corpus for instance when the text belongs to an emerging field To solve this issue CAT research has looked into the leveraging of comparable corpora i e a set of texts in two or more languages which deal with the same topic but are not translations of one another This work had two primary objectives The first is to assess the input of lexicons extracted from comparable corpora in the context of a specialized human translation task The second objective is to identify bilingual lexicon extraction methods which best match the translators needs determining the current limits of these techniques and suggesting improvements The author focuses in particular on the identification of fertile translations the management of multiple morphological structures and the ranking of candidate translations The experiments are carried out on two language pairs English French and English German and on specialized texts dealing with breast cancer This research puts significant emphasis on applicability methodological choices are guided by the needs of the final users This book is organized in two parts the first part presents the applicative and scientific context of the research and the second part is given over to efforts to improve compositional translation The research work presented in this book received the PhD Thesis award 2014 from the French association for natural language processing ATALA **Recent Advances in Example-Based Machine Translation** M. Carl,Andy Way,2012-12-06 Recent Advances in Example Based Machine Translation is of relevance to researchers and program developers in the field of Machine Translation and especially Example Based Machine Translation bilingual text processing and cross linguistic information retrieval It is also of interest to translation technologists and localisation professionals Recent Advances in Example Based Machine Translation fills a void because it is the first book to tackle the issue of EBMT in depth It gives a

state of the art overview of EBMT techniques and provides a coherent structure in which all aspects of EBMT are embedded Its contributions are written by long standing researchers in the field of MT in general and EBMT in particular This book can be used in graduate level courses in machine translation and statistical NLP

Machine Translation and Translation Theory Christa Hauenschild,Susanne Heizmann,1997 The series serves to propagate investigations into language usage especially with respect to computational support This includes all forms of text handling activity not only interlingual translations but also conversions carried out in response to different communicative tasks Among the major topics are problems of text transfer and the interplay between human and machine activities

Representation Theory Edwin Williams,2002-12-20 In this theoretical monograph Edwin Williams demonstrates that when syntax is economical it economizes on shape distortion rather than on distance According to Williams this new notion of economy calls for a new architecture for the grammatical system in fact for a new notion of derivation The new architecture offers a style of clausal embedding the Level Embedding Scheme that predictively ties together the locality reconstructive behavior and target type of any syntactic process in a way that is unique to the model Williams calls his theory Representation Theory to put the notion of economy at the forefront Syntax in this theory is a series of representations of one sublanguage in another

Logic, Rationality, and Interaction Alexandru Baltag,Jeremy Seligman,Tomoyuki Yamada,2017-09-01 This LNCS volume is part of FoLLI book serie and contains the papers presented at the 6th International Workshop on Logic Rationality and Interaction LORI VI held in September 2017 in Sapporo Japan The focus of the workshop is on following topics Agency Argumentation and Agreement Belief Revision and Belief Merging Belief Representation Cooperation Decision making and Planning Natural Language Philosophy and Philosophical Logic and Strategic Reasoning

Idioms and Collocations in Compositional Grammars André Schenk,1993

Healthcare Data Analytics Chandan K. Reddy,Charu C. Aggarwal,2015-06-23 At the intersection of computer science and healthcare data analytics has emerged as a promising tool for solving problems across many healthcare related disciplines Supplying a comprehensive overview of recent healthcare analytics research Healthcare Data Analytics provides a clear understanding of the analytical techniques currently available

Incommensurability and Translation Rema Rossini Favretti,Giorgio Sandri,Roberto Scazzieri,1999 This book explores an evolutionary theory of scientific knowledge and provides the basis for a new linguistic approach to methodology Including an original essay by the late Thomas Kuhn this volume takes inspiration from his work in history and the philosophy of sciences The authors highlight the critical importance of the relationship between the process of learning a language and translation and use this to examine scientific language and interpretation They also analyse the relationship between grammatical structure and theoretical communication in science and apply their findings to the rhetoric of Smith and Keynes They assess the pragmatismal dimension of language in the construction of knowledge and examine its role in explaining economic behaviour and in interpreting the relationship between economics and philosophy Finally the authors analyse the relationship

between incommensurable standards and translation from the point of view of the logical structure of lexicon and examine the traditional theme of the unity of science across the whole spectrum of humanities and the social sciences The Translator ,1998 **Yearbook** ,1997 **Machine Translation** Association for Machine Translation in the Americas. Conference,2002 **Machine Translation and the Information Soup** Association for Machine Translation in the Americas. Conference,1998 Highways in College Composition Homer Andrew Watt,Oscar Cargill,1930 A Literal English Translation of Bāṇa's Kādambarī (Pūrvabhāga Complete) Bāṇa Bhaṭṭa,Bāṇa,Moreshvar Ramchandra Kale,1924 *Linguistics and Language Behavior Abstracts* ,1999 **Mathematical Foundations of Computer Science** ,1998 Possessive Descriptions Chris Barker,1991 **Advances in Artificial Intelligence** Canadian Society for Computational Studies of Intelligence. Conference,2000 **Computational Linguistics in the Netherlands ...** ,2000

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