

CONTRIBUTIONS TO ENGLISH TO HINDI
MACHINE TRANSLATION USING
EXAMPLE-BASED APPROACH

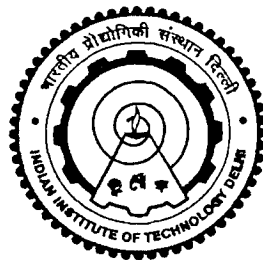
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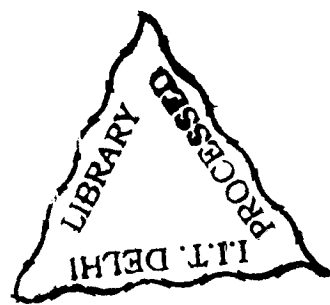
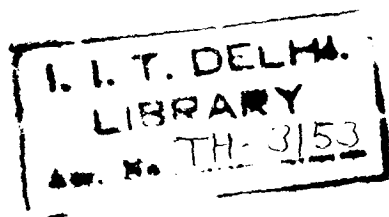
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Dedicated to

My Parents,

My Brother Ashish and

My Thesis Supervisor...

Certificate

This is to certify that the thesis entitled “Contributions to English to Hindi Machine Translation Using Example-Based Approach” submitted by Ms. Deepa Gupta to the Department of Mathematics, Indian Institute of Technology Delhi, for the award of the degree of Doctor of Philosophy, is a record of *bona fide* research work carried out by her under my guidance and supervision.

The thesis has reached the standards fulfilling the requirements of the regulations relating to the degree. The work contained in this thesis has not been submitted to any other university or institute for the award of any degree or diploma.



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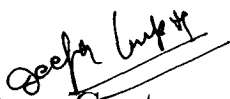
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Abstract

This research focuses on development of Example Based Machine Translation (EBMT) system for English to Hindi. Development of a machine translation (MT) system typically demands a large volume of computational resources. For example, rule-based MT systems require extraction of syntactic and semantic knowledge in the form of rules, statistics-based MT systems require huge parallel corpus containing sentences in the source languages and their translations in target language. Requirement of such computational resources is much less in respect of EMBT. This makes development of EBMT systems for English to Hindi translation feasible, where availability of large-scale computational resources is still scarce. The primary motivation for this work comes because of the following:

- a) Although a small number of English to Hindi MT systems are already available, the outputs produced by them are not of high quality all the time. Through this work we intend to analyze the difficulties that lead to this below par performance, and try to provide some solutions for them.
- b) There are several other major languages (e.g., Bengali, Punjabi, Gujrathi) in the Indian subcontinent. Demand for developing MT systems from English to these languages is increasing rapidly. But at the same time, development of computational resources in these languages is still at its infancy. Since many of these languages are similar to Hindi, syntactically as well as lexicon wise, the research carried out here should help developing MT systems from English to these languages as well.

The major contributions of this research may be described as follows:

- 1) Development of a systematic adaptation scheme. We proposed an adaptation scheme consisting of ten basic operations. These operations work not only at word level, but at suffix level as well. This makes adaptation less expensive in many situations.
- 2) Study of Divergence. We observe that occurrence of divergence causes major difficulty for any MT systems. In this work we make an in depth study of the different types of divergence, and categorize them.
- 3) Development of Retrieval scheme. We propose a novel approach for measuring similarity between sentences. We suggest that retrieval strategy, with respect to an EBMT system, will be most efficient if it measures similarity on the basis of cost of adaptation. In this work we provide a complete framework for an efficient retrieval scheme on the basis of our studies on “divergence” and “cost of adaptation”.
- 4) Dealing with Complex sentences. Handling complex sentences by an MT system is generally considered to be difficult. In this work we propose a “split and translate” technique for translating complex sentences under an EBMT framework.

We feel that the overall scheme proposed in this research will pave the way for developing an efficient EBMT system for translating from English to Hindi. We hope that this research will also help development of MT systems from English to other languages of the Indian subcontinent.

Contents

1	Introduction	1
1.1	Description of the Work Done and Summary of the Chapters	6
1.2	Some Critical Points	19
2	Adaptation in English to Hindi Translation: A Systematic Approach	23
2.1	Introduction	23
2.2	Description of the Adaptation Operations	29
2.3	Study of Adaptation Procedure for Morphological Variation of Active Verbs	36
2.3.1	Same Tense Same Verb Form	38
2.3.2	Different Tenses Same Verb Form	42
2.3.3	Same Tense Different Verb Forms	46
2.3.4	Different Tenses Different Verb Forms	48
2.4	Adaptation Procedure for Morphological Variation of Passive Verbs .	51
2.5	Study of Adaptation Procedures for Subject/ Object Functional Slot	56
2.5.1	Adaptation Rules for Variations in the Morpho Tags of @DN>	59

Contents

2.5.2	Adaptation Rules for Variations in the Morpho Tags of @GN>	60
2.5.3	Adaptation Rules for Variations in the Morpho Tags of @QN .	64
2.5.4	Adaptation Rules for Variations in the Morpho Tags of Pre- modifier Adjective @AN>	64
2.5.5	Adaptation Rules for Variations in the Morpho Tags of @SUB	69
2.6	Adaptation of Interrogative Words	73
2.7	Adaptation Rules for Variation in Kind of Sentences	83
2.8	Concluding Remarks	85
3	An FT and SPAC Based Divergence Identification Technique From Example Base	87
3.1	Introduction	87
3.2	Divergence and Its Identification: Some Relevant Past Work	89
3.3	Divergences and Their Identification in English to Hindi Translation .	96
3.3.1	Structural Divergence	97
3.3.2	Categorical Divergence	100
3.3.3	Nominal Divergence	104
3.3.4	Pronominal Divergence	107
3.3.5	Demotional Divergence	111
3.3.6	Conflational Divergence	117
3.3.7	Possessional Divergence	121
3.3.8	Some Critical Comments	131

3.4	Concluding Remarks	132
4	A Corpus-Evidence Based Approach for Prior Determination of Divergence	135
4.1	Introduction	135
4.2	Corpus-Based Evidences and Their Use in Divergence Identification .	136
4.2.1	Roles of Different Functional Tags	138
4.3	The Proposed Approach	147
4.4	Illustrations and Experimental Results	155
4.4.1	Illustration 1	155
4.4.2	Illustration 2	157
4.4.3	Illustration 3	158
4.4.4	Experimental Results	166
4.5	Concluding Remarks	168
5	A Cost of Adaptation Based Scheme for Efficient Retrieval of Translation Examples	171
5.1	Introduction	171
5.2	Brief Review of Related Past Work	171
5.3	Evaluation of Cost of Adaptation	178
5.3.1	Cost of Different Adaptation Operations	182
5.4	Cost Due to Different Functional Slots and Kind of Sentences	185

Contents

5.4.1	Costs Due to Variation in Kind of Sentences	186
5.4.2	Cost Due to Active Verb Morphological Variation	187
5.4.3	Cost Due to Subject/Object Functional Slot	192
5.4.4	Use of Adaptation Cost as a Measure of Similarity	197
5.5	The Proposed Approach vis-à-vis Some Similarity Measurement Schemes	
	198	
5.5.1	Semantic Similarity	198
5.5.2	Syntactic Similarity	201
5.5.3	A Proposed Approach: Cost of Adaptation Based Similarity .	203
5.5.4	Drawbacks of the Proposed Scheme	211
5.6	Two-level Filtration Scheme	213
5.6.1	Measurement of Structural Similarity	214
5.6.2	Measurement of Characteristic Feature Dissimilarity	217
5.7	Complexity Analysis of the Proposed Scheme	222
5.8	Difficulties in Handling Complex Sentences	226
5.9	Splitting Rules for Converting Complex Sentence into Simple Sentences	229
5.9.1	Splitting Rule for the Connectives “when”, “where”, “when- ever” and “wherever”	231
5.9.2	Splitting Rule for the Connective “who”	241
5.10	Adaptation Procedure for Complex Sentence	253
5.10.1	Adaptation Procedure for Connectives “when”, “where”, “when- ever” and “wherever”	254

5.10.2	Adaptation Procedure for Connective “who”	256
5.11	Illustrations	260
5.11.1	Illustration 1	260
5.11.2	Illustration 2	262
5.12	Concluding Remarks	264
6	Discussions and Conclusions	267
6.1	Goals and Motivation	267
6.2	Contributions Made by This Research	268
6.3	Possible extensions	272
6.4	Epilogue	273
6.4.1	Pre-editing and Post-editing	274
6.4.2	Evaluation Measures of Machine Translation	276
	Appendices	280
A		281
A.1	English and Hindi Language Variations	281
A.2	Verb Morphological and Structure Variations	285
A.2.1	Conjugation of Root Verb	286
B		291
B.1	Functional Tags	291
B.2	Morpho Tags	294

Contents

C	299
C.1 Definitions of Some Non-typical Functional Tags and SPAC Structures	299
D	303
D.1 Semantic Similarity	303
E	305
E.1 Cost Due to Adapting Pre-modifier Adjective to Pre-modifier Adjective	305
Bibliography	308