Contents

Abstract ii

Acknowledgements iii

List of Tables viii

List of Figures xi

List of Code Listings xiii

Introduction xiv

I Semantic Textual Similarity 1

1 Introduction 2

1.1 Semantic Textual Similarity Approaches 2

1.2 Datasets 4

1.2.1 English Datasets 4

1.2.2 Datasets on Other Languages 19

1.2.3 Datasets on Different Domains 24

1.3 Evaluation Metrics 28

1.4 Contributions 33

2 Improving State of the Art Methods 35

2.1 Related Work 37

2.1.1 Cosine Similarity on Average Vectors 38

2.1.2 Word Mover's Distance 38

2.1.3 Cosine Similarity Using Smooth Inverse Frequency . . . 38
2.2 Improving State of the Art STS Methods . . . 42
2.3 Portability to Other Languages . . . 52
2.4 Portability to Other Domains . . . 54
2.5 Conclusions . . . 55
3 Exploring STS with Sentence Encoders 58
3.1 Introduction . . . 58
3.2 Related Work . . . 61
3.3 Exploring Sentence Encoders in English STS . . . 66
3.4 Portability to Other Languages . . . 69
3.5 Portability to Other Domains . . . 71
3.6 Conclusions . . . 74
4 Siamese Neural Networks for STS 76
4.1 Introduction . . . 76
4.2 Related Work . . . 79
4.3 Exploring Siamese Neural Networks for STS . . . 81
4.3.1 Impact of Transfer Learning . . . 85
4.3.2 Impact of Data Augmentation . . . 88
4.4 Portability to Other Languages . . . 90
4.5 Portability to Other Domains . . . 93
4.6 Conclusions . . . 95
5 Adopting Transformers for STS 98
5.1 Introduction . . . 98

5.2 Related Work . . . 99
5.3 Transformer Architecture for STS . . . 102
5.4 Exploring Transformers in English STS . . . 102
5.4.1 Impact of Transfer Learning . . . 103
5.4.2 Impact of Data Augmentation . . . 103
5.5 Portability to Other Languages . . . 103
5.6 Potability to Other Domains . . . 103
5.7 Recent Developments: Siamese Transformers . . . 103
5.8 Conclusions . . . 103

II Applications - Translation Memories 104

1 Introduction 105

1.1 What is Translation Memory? . . . 105
1.2 Datasets . . . 105
1.3 Related Work . . . 105
1.4 STS for Translation Memories . . . 105

2 Sentence Encoders for Translation Memories 106

2.1 Introduction . . . 106
2.2 Methodology . . . 106
2.3 Results and Evaluation . . . 106

III Applications - Translation Quality Estimation 107

1 Introduction 108

1.1 What is Translation Quality Estimation? . . . 108
1.2 Datasets . . . 108
1.3 Related Work . . . 108
1.4 STS for Translation Quality Estimation . . . 108
1.5 Conclusion . . . 108
2 TransQuest: STS Architectures for QE 109
2.1 Introduction . . . 109
2.2 Methodology . . . 109
2.3 Results and Evaluation . . . 109
2.4 Conclusion . . . 109
3 Extending TransQuest for word-level QE 112
3.1 Introduction . . . 112
3.2 Related Work . . . 112
3.3 Methodology . . . 112
3.4 Results and Evaluation . . . 112
3.5 Conclusion . . . 112
4 Multilingual Quality Estimation with TransQuest 114
4.1 Introduction . . . 114
4.2 Multilingual Sentence-Level QE . . . 115
4.3 Multilingual Word-Level QE . . . 115
4.4 Conclusion . . . 115
Bibliography 116