List of Figures

1.1 Voice-enabled IPAs ......................... 2
1.2 Block diagram representation of STD system ....................... 4
1.3 Block diagram of QbE-STD system ......................... 5
1.4 Block diagram representation of AKWS system .................. 7
1.5 Flowchart of the organization of the thesis ...................... 10

2.1 A schematic of generic block diagram of QbE-STD system .......... 14
2.2 A graphical representation of hit, miss and false alarm .......... 17
2.3 A schematic of posteriorgram plot .......................... 22
2.4 Phonetic posteriorgrams examples ............................ 23
2.5 Gaussian posteriorgrams examples ............................ 26
2.6 The schematic diagram for ASM computation .................... 28
2.7 The schematic flow diagram of DBN posteriorgram feature extraction 29
2.8 An example of segmental DTW ............................... 31
2.9 An illustration of KNN search with LB estimate to speedup SDTW 33
2.10 Illustration of re-scoring using the pseudo relevance feedback 39
2.11 Selected chronological progress during last few years in QbE-STD research problem ......................... 43

3.1 Schematic block diagram of MFCC-TMP feature extraction .......... 54
3.2 Generation of warping path using subDTW and local constraints used in subDTW .................................. 57
3.3 The graphical representation of matrices associated in subDTW operation ........................................ 58
3.4 The distribution of unnormalized and normalized scores .............. 63
3.5 Illustration of fusion for three QbE-STD systems .................. 65
3.6 Types of local constraints used ................................ 68
3.7 Performance of various dissimilarity functions on SWS 2013 QbE-STD task ........................................ 69

4.1 Mel filterbank for different VTLN warping factors .................. 72
D.1 Flowchart of K-means vector quantization . . . . . . . . . . . . . . . 171

E.1 The selection of optimal threshold, $\theta$, optimizing TWV . . . . . . . 173

F.1 Impact on TWV for different $\beta$. . . . . . . . . . . . . . . . . . . . . 176