Contents

Title Page i

Certificate of Approval v

Certificate vii

Declaration ix

Acknowledgement xi

Contents xiii

List of Abbreviations xvii

List of Symbols xix

List of Figures xxi

List of Tables xxv

Abstract xxvii

1 Introduction 1

1.1 Introduction 2
1.2 Error Resiliency 2
1.3 Error Concealment 3
1.4 Challenges 4
1.5 Problem Definition 5
1.6 Literature Survey 5

1.6.1 Existing Works on Scene Change Detection (SCD) and Hybrid Concealment Scheme 5
1.6.2 Existing Works on Error Resiliency 7
1.6.3 Existing Works on Error Concealment 9
1.7 Outline of the Thesis 14

2 Hybrid Error Concealment Based on Scene Transitions and Edge Preserving Spatial Error Concealment 17
2.1 Introduction 18
2.2 Hybrid Error Concealment Based on Scene Transitions and Edge Preserving Spatial Error Concealment 18
2.2.1 Scene and Illumination Change Index (SICI) 19
2.2.2 Directional Edge Based Spatial Error Concealment(DEBSEC) . 21
2.2.3 Hybrid Error Concealment Scheme 25
2.3 Results and Discussion 25
2.3.1 Scene and Illumination Change Detection 26
2.3.2 DEBSEC 27
2.3.3 Hybrid Concealment 31
2.4 Summary 47

3 Scene Content Based FEC Allocation Minimizing end-to-end Distortion in Video Transmission 49
3.1 Introduction 50
3.2 Problem Formulation 51
3.2.1 End-to-end Distortion Estimation 52
3.3 Model Based GCASCP (GCASCP-M) 55
3.3.1 Scene Change Parameter 55
3.3.2 Unequal FEC allocation 56
3.3.3 Function Optimization 58
3.4 Heuristic Based GCASCP (GCASCP-H) 59
3.4.1 Scene Content Based Initial FEC Allocation 61
3.4.2 Final FEC Allocation 64
3.5 FEC Allocation for Conversational Video 65
3.6 Results and Discussion 68
3.6.1 Performance of GCASCP Methods 69
3.6.2 Performance of FEC Allocation Scheme for Conversational Video 70
3.7 Summary 71

4 3-D Model Assisted Video Error Concealment **77**
4.1 Introduction . . . 78
4.2 Model Adaptation and Tracking . . . 78
4.2.1 Facial Feature Point Extraction . . . 83
4.2.2 Feature Point Tracking . . . 84
4.2.3 Model Adaptation . . . 86
4.3 Concealment Algorithm . . . 92
4.3.1 Case A: Concealment of Feature Points . . . 92
4.3.2 Case B: Concealment of the other facial area . . . 93
4.4 Results & Discussion . . . 94
4.4.1 Face Model Adaptation . . . 94
4.4.2 Error Concealment Result . . . 95
4.5 Summary . . . 97

5 Conclusion and Future Directions **115**
5.1 Summary and Conclusions . . . 116
5.2 Contribution of the thesis . . . 118
5.3 Future Scope . . . 120

A Models and Measures **121**
A.1 Introduction . . . 122
A.2 Image Quality Assessment Parameters . . . 122
A.2.1 Mean Square Error (MSE) . . . 122
A.2.2 Peak Signal to Noise Ratio (PSNR) . . . 122
A.2.3 Structural Similarity Index (SSIM) . . . 123
A.3 Candide-3 Face Model . . . 124
A.4 Kalman Filter . . . 124

References **128**

Publications **139**

Author's Biography **141**