Mestrado Integrado em Engenharia Informática

Otimização em Machine Learning
Grupo A

Anexos

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1 Resultados com *Dataset Mnist* para as classes 0123

1.1 *Perceptron* Primal com *OVA*

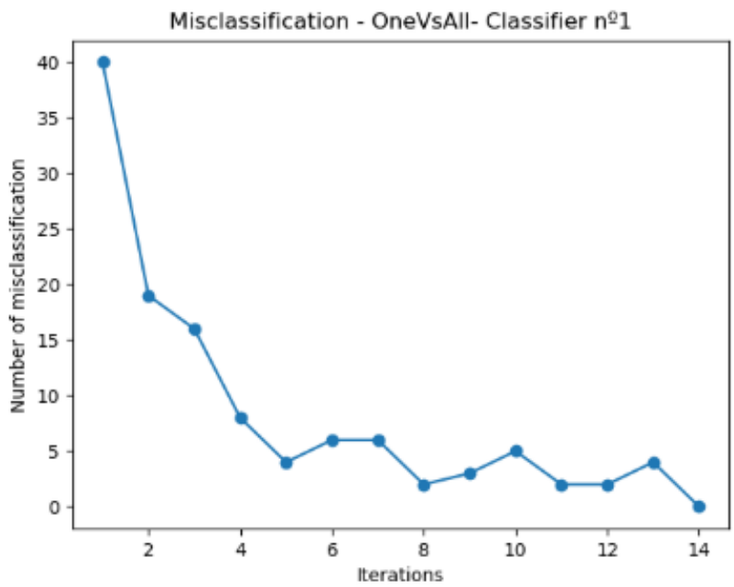

Figura 1: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

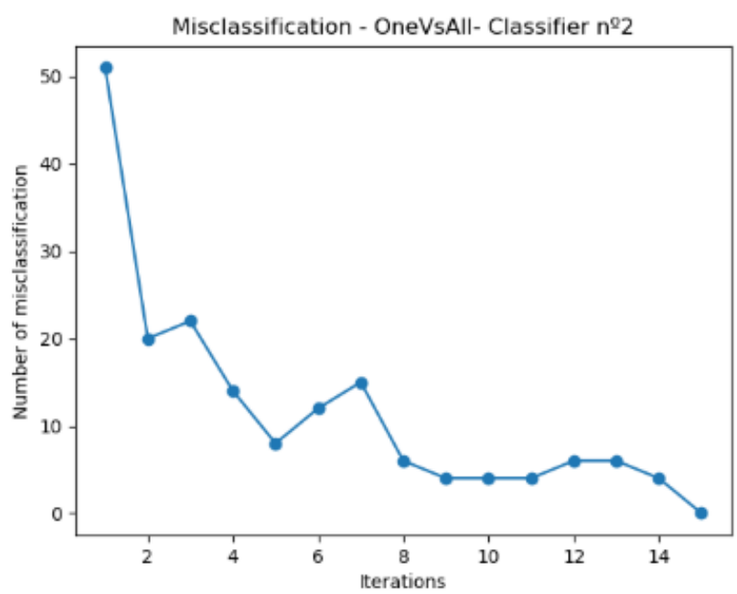

Figura 2: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

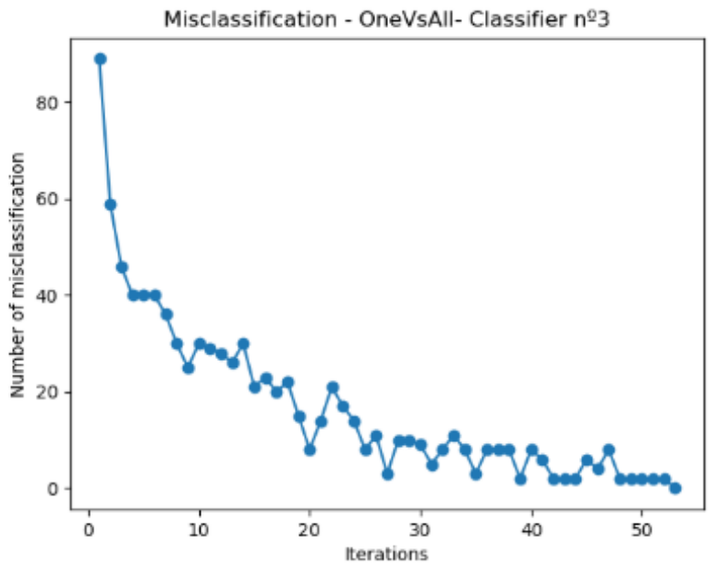

Figura 3: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

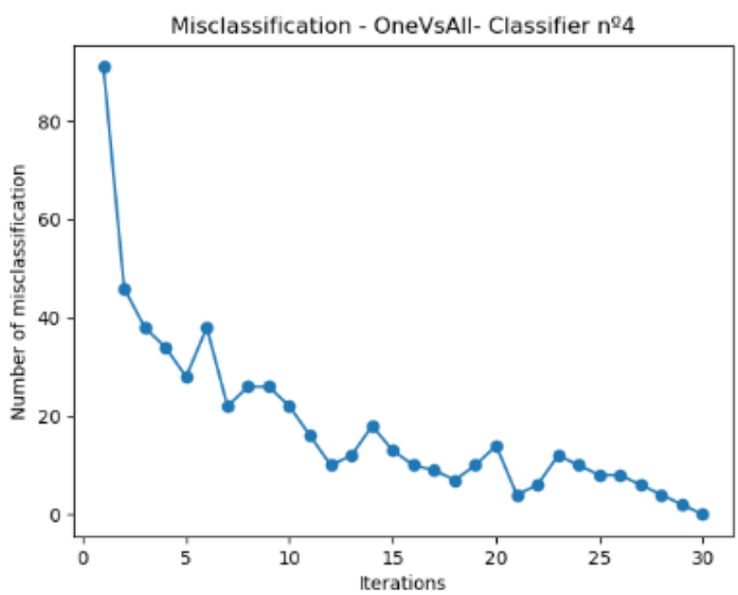

Figura 4: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

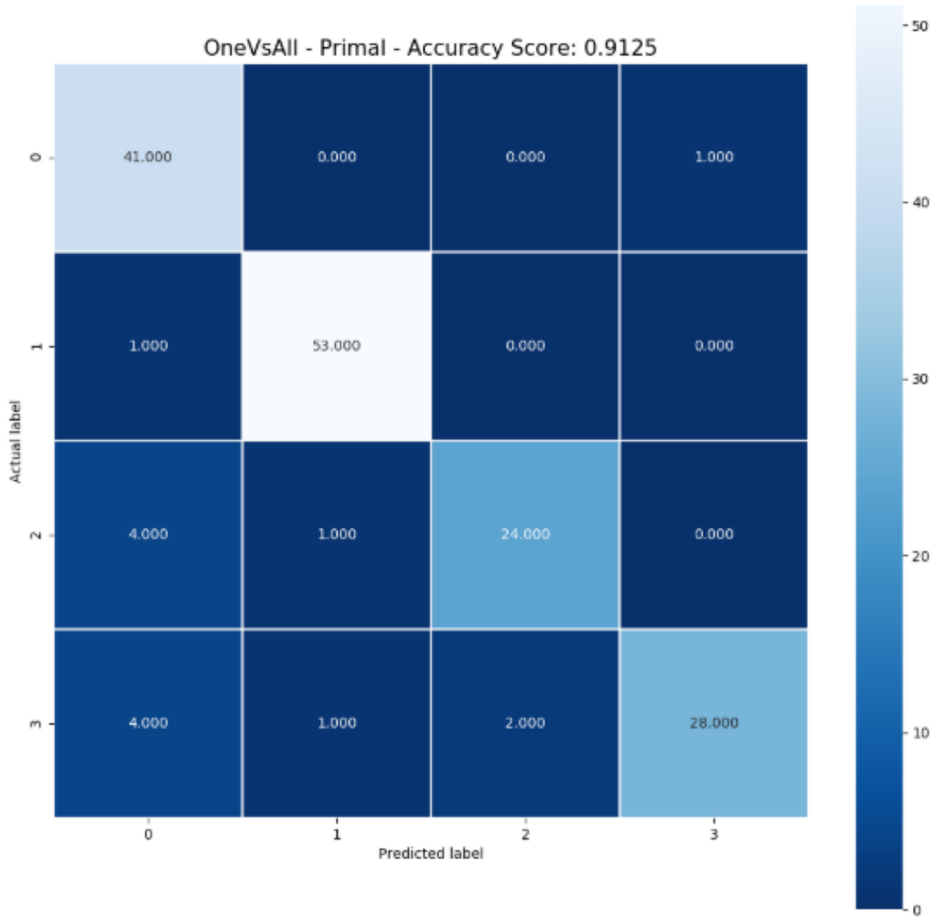

Figura 5: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

1.2 *Perceptron* Primal com *OVO*

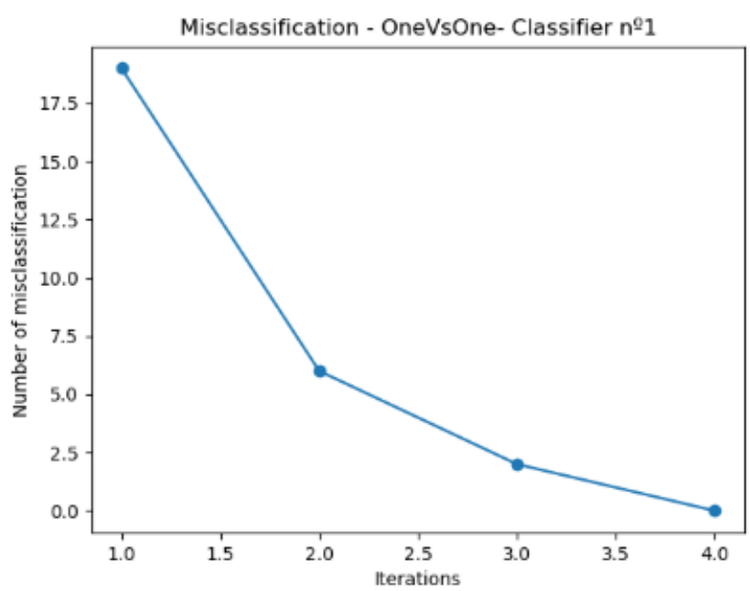

Figura 6: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

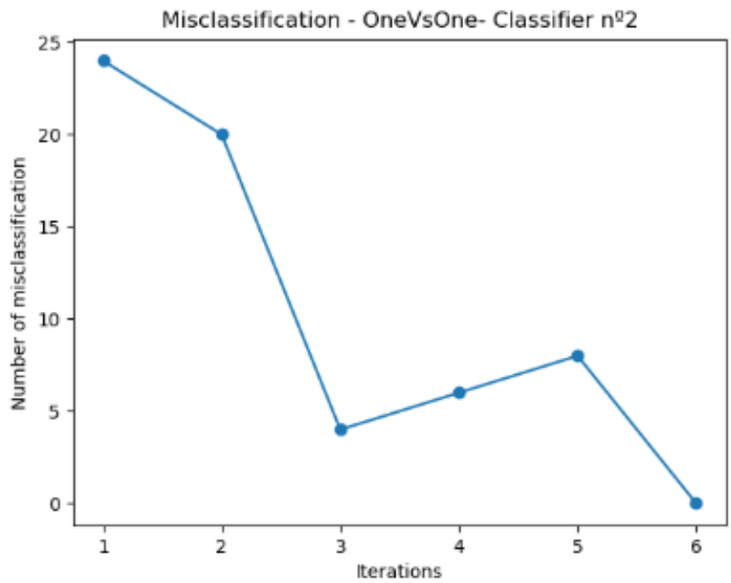

Figura 7: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

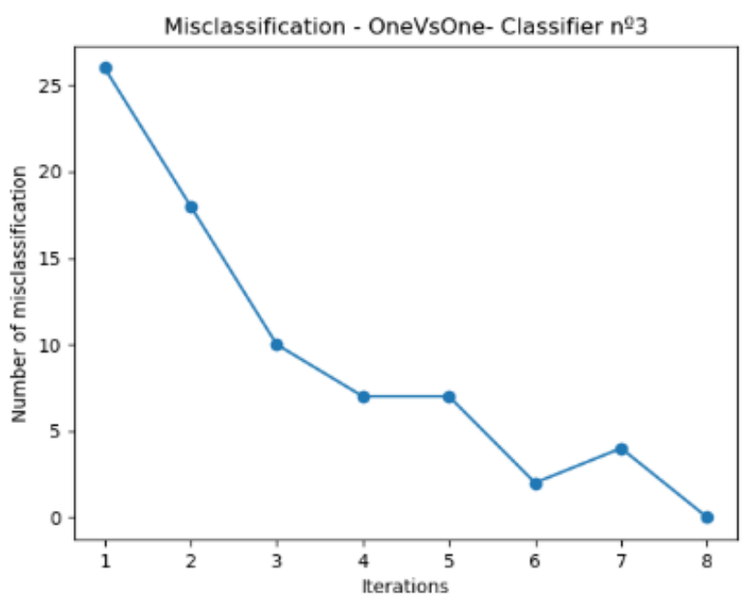

Figura 8: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

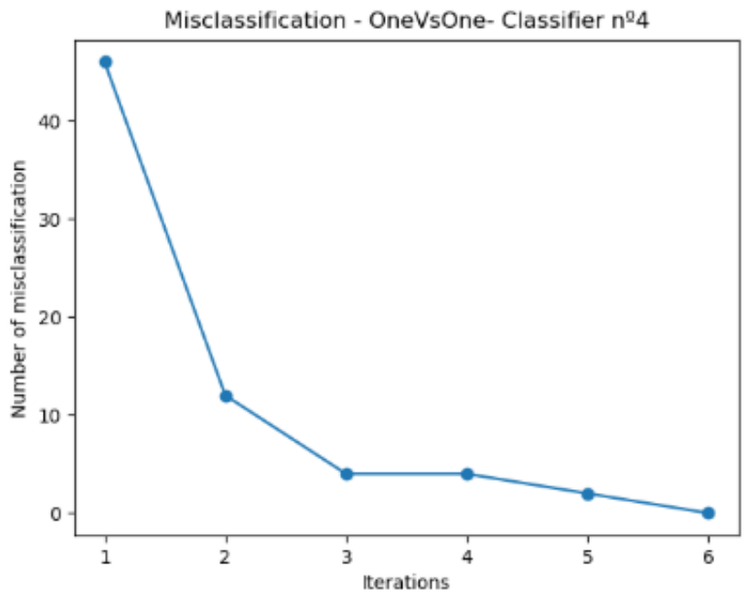

Figura 9: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

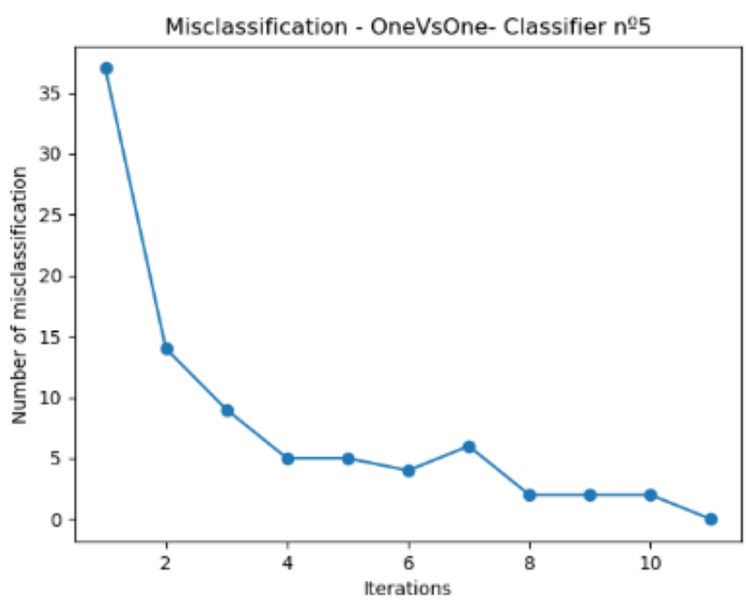

Figura 10: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

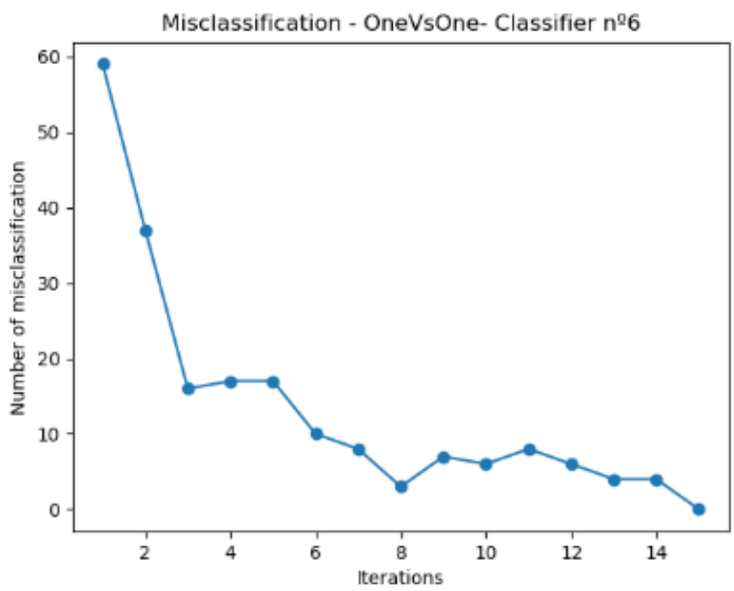

Figura 11: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

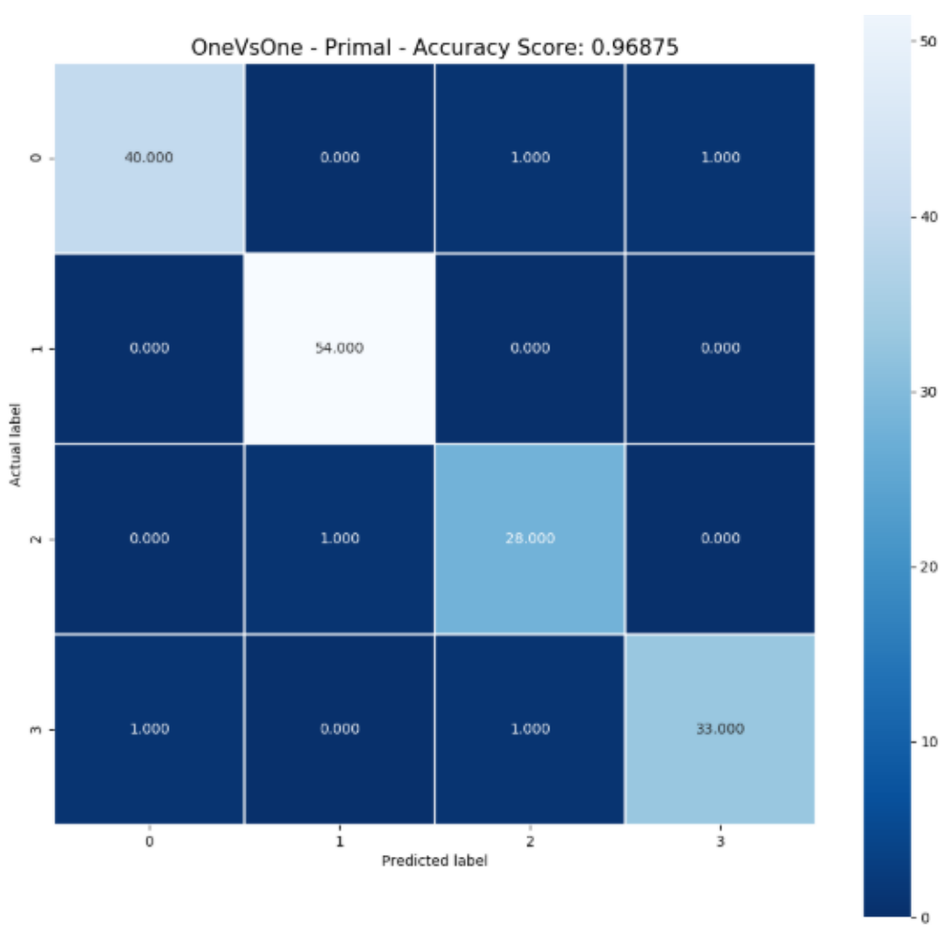

Figura 12: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

1.3 *Perceptron* Primal com *ECOC*

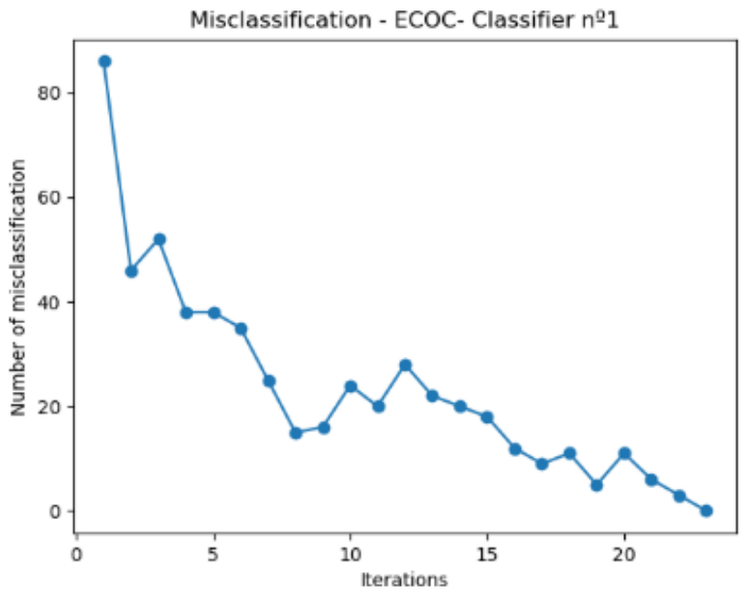

Figura 13: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

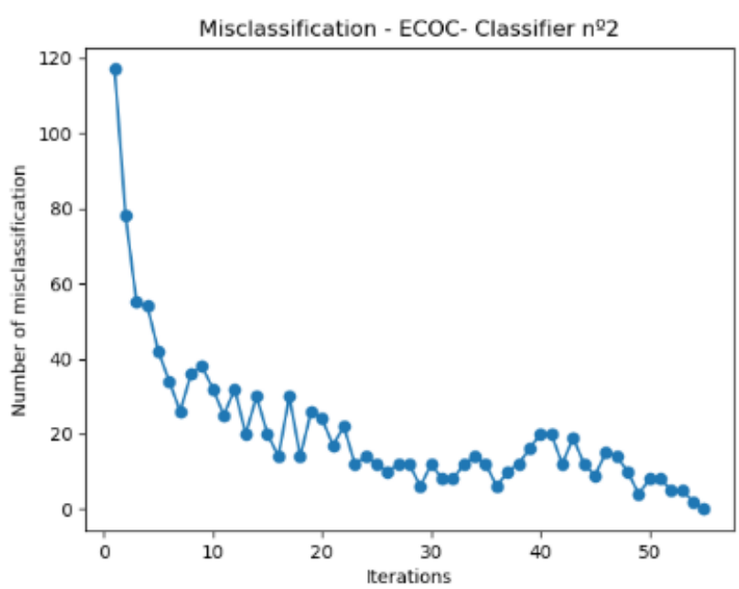

Figura 14: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

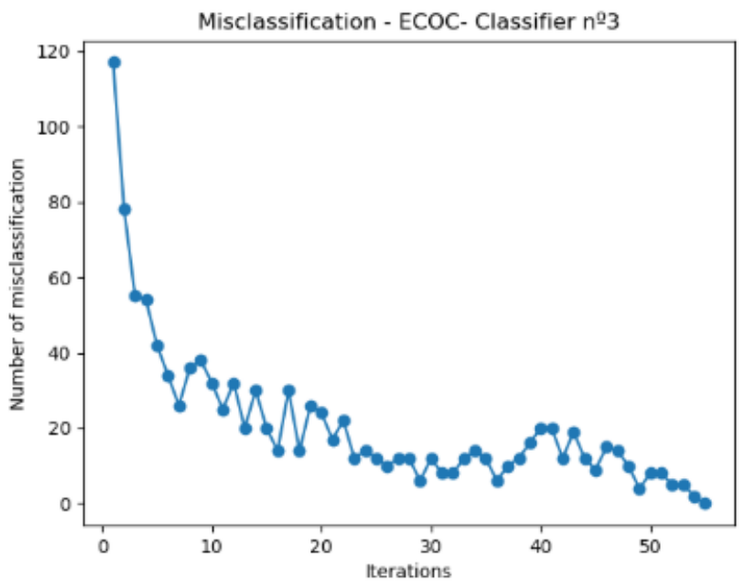

Figura 15: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

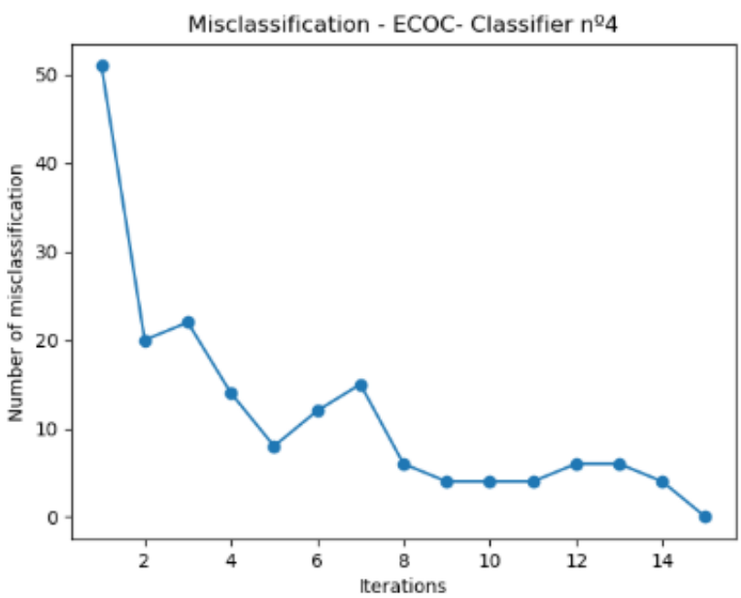

Figura 16: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

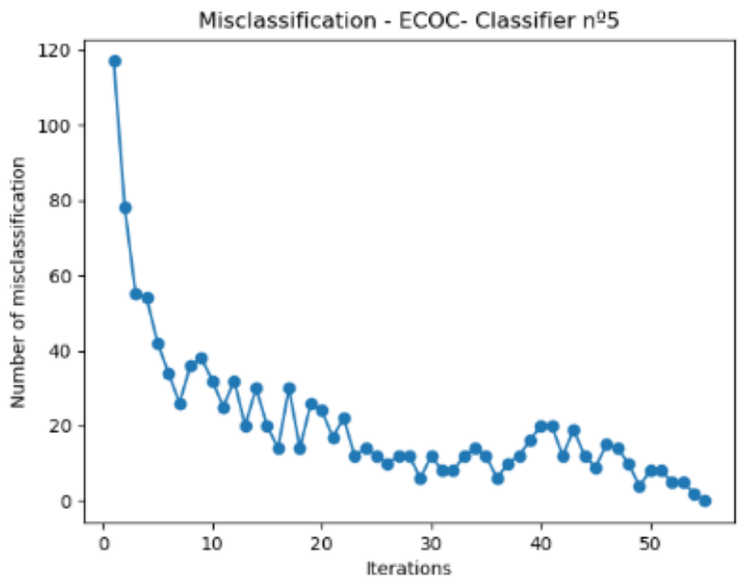

Figura 17: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

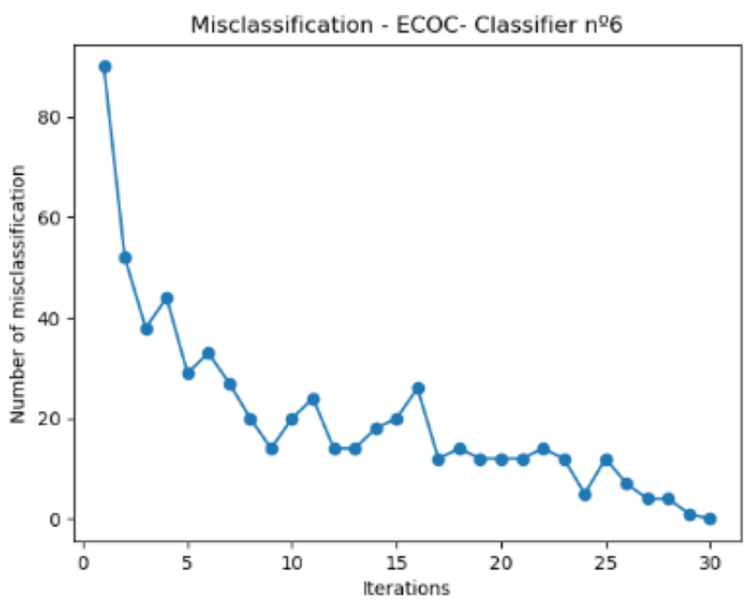

Figura 18: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

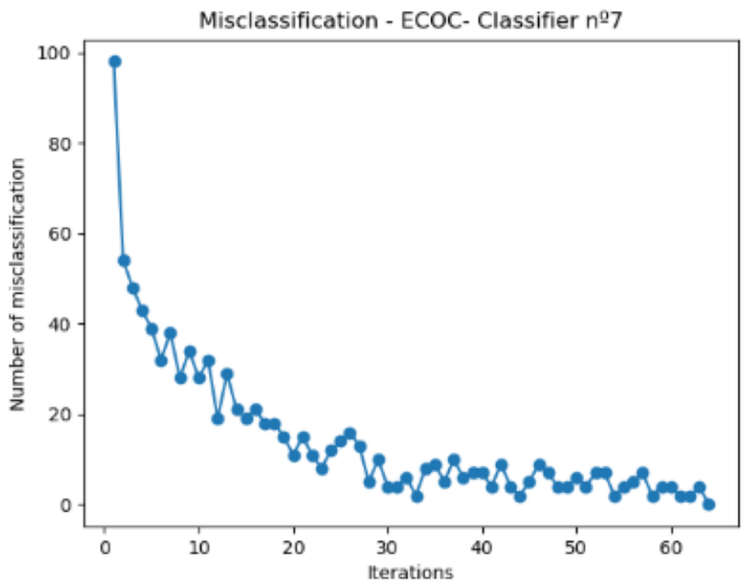

Figura 19: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

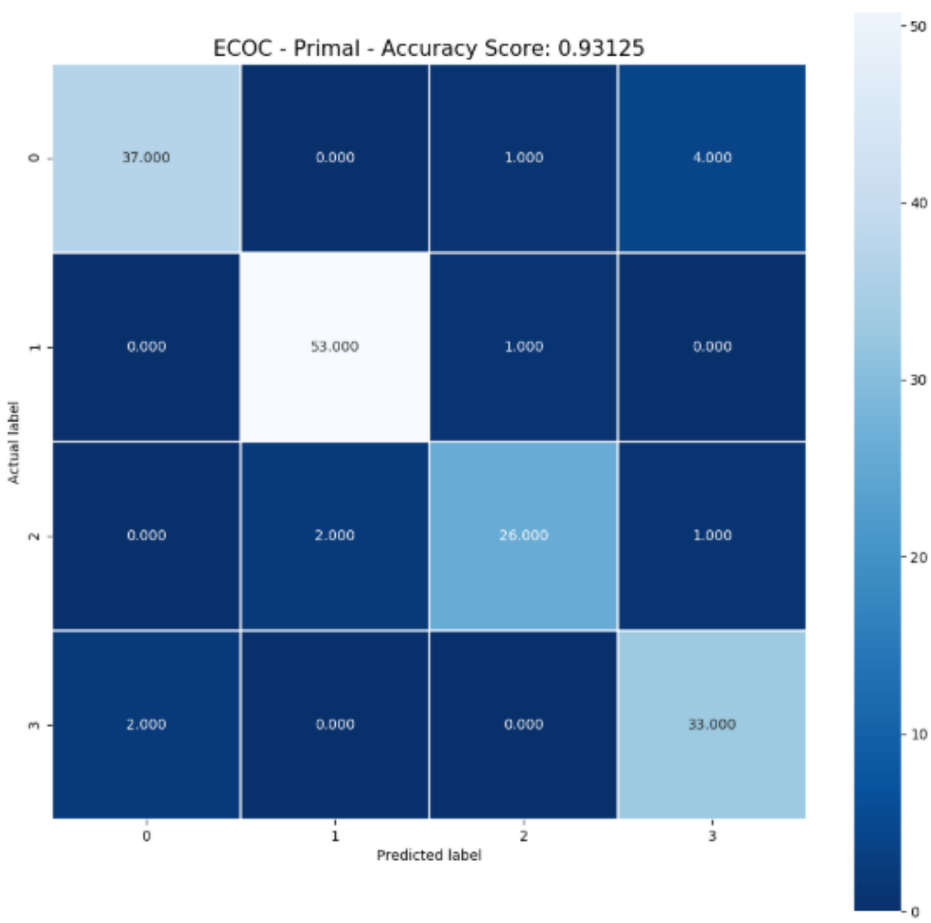

Figura 20: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

1.4 *Perceptron* Dual com *OVA*

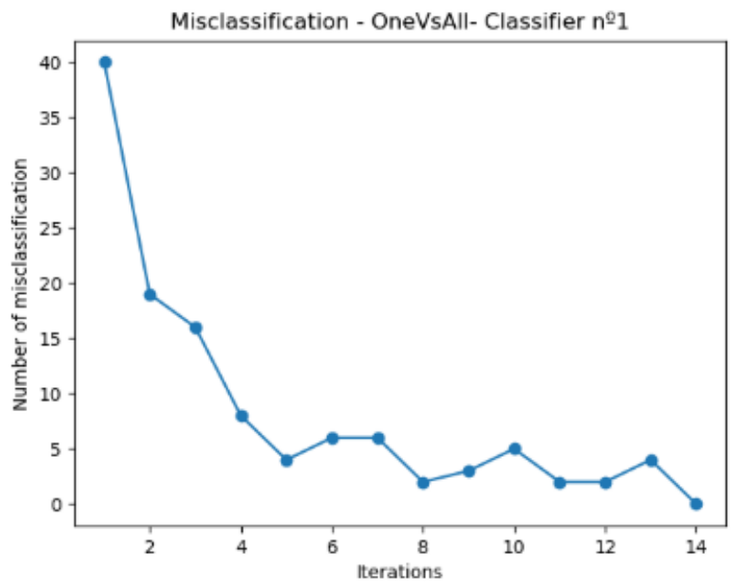

Figura 21: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

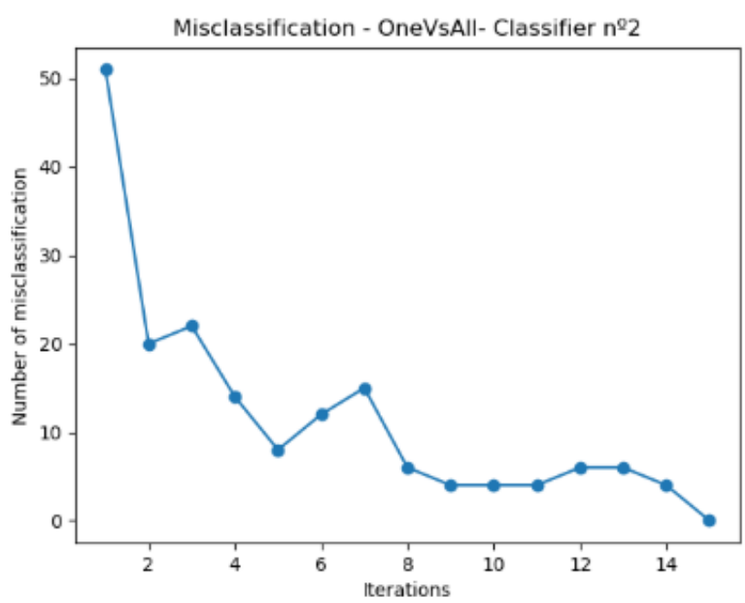

Figura 22: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

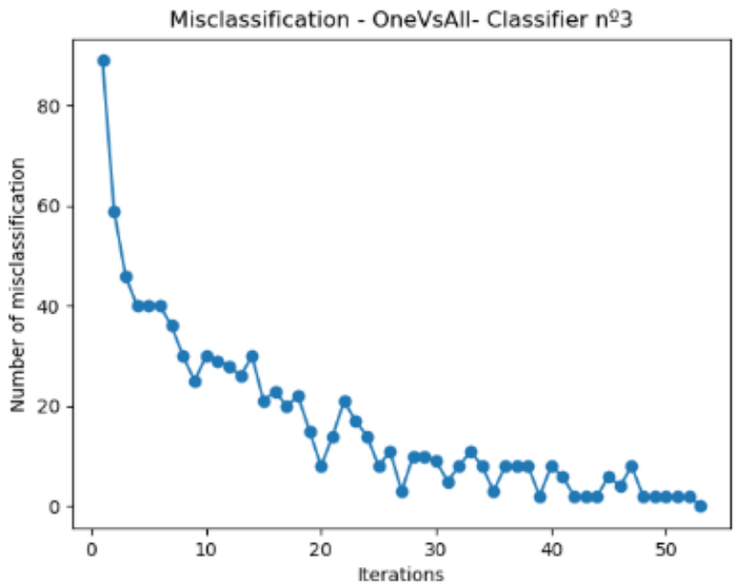

Figura 23: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

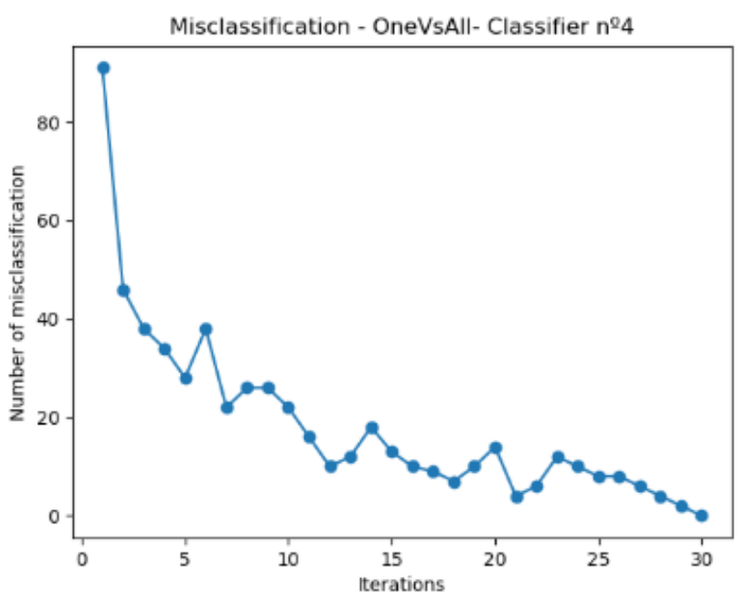

Figura 24: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

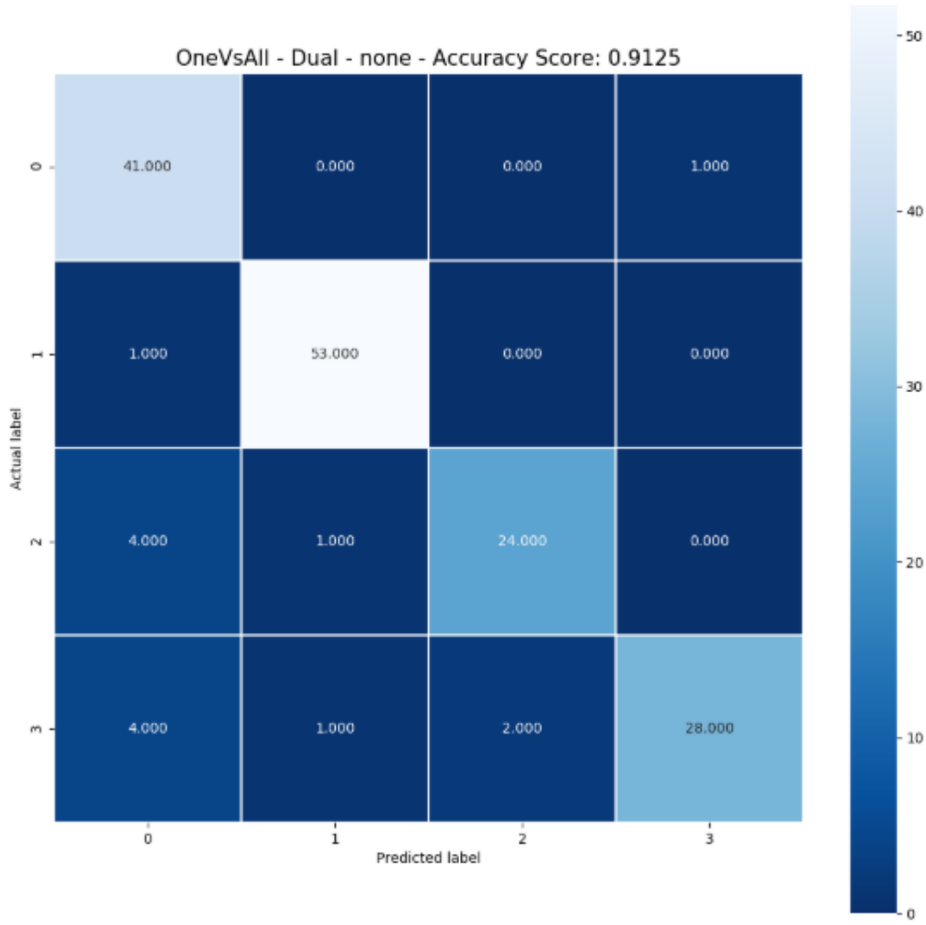

Figura 25: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

1.5 *Perceptron* Dual com *OVO*

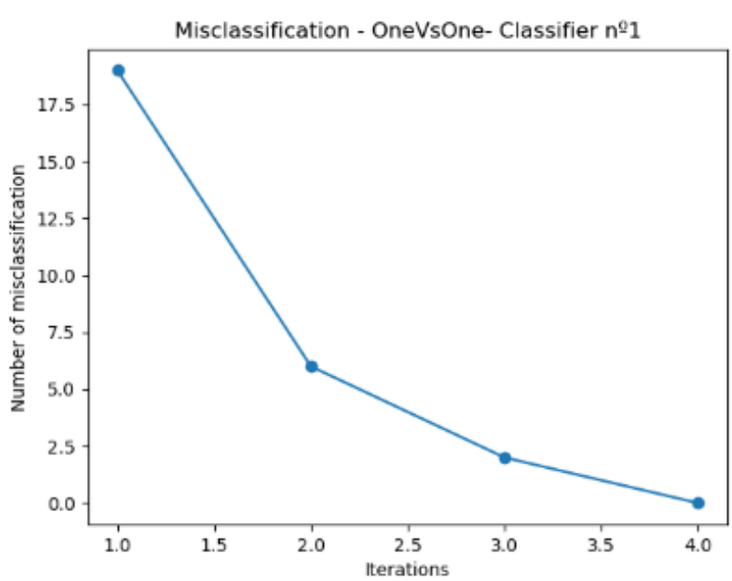

Figura 26: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

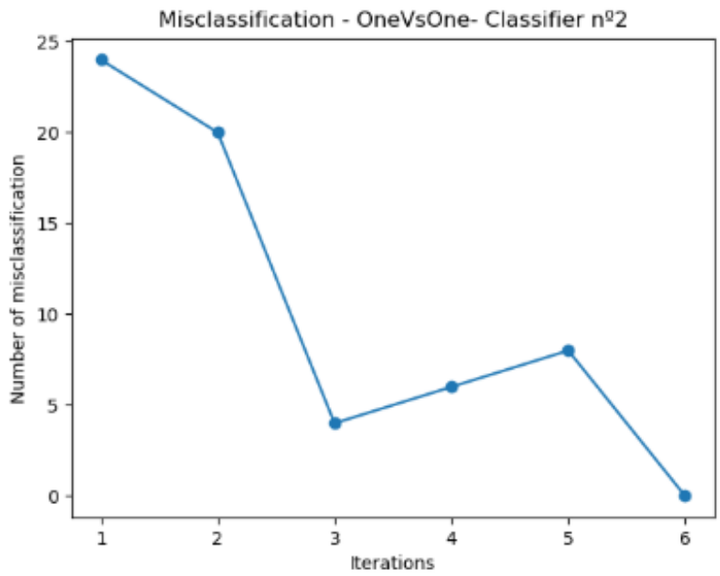

Figura 27: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

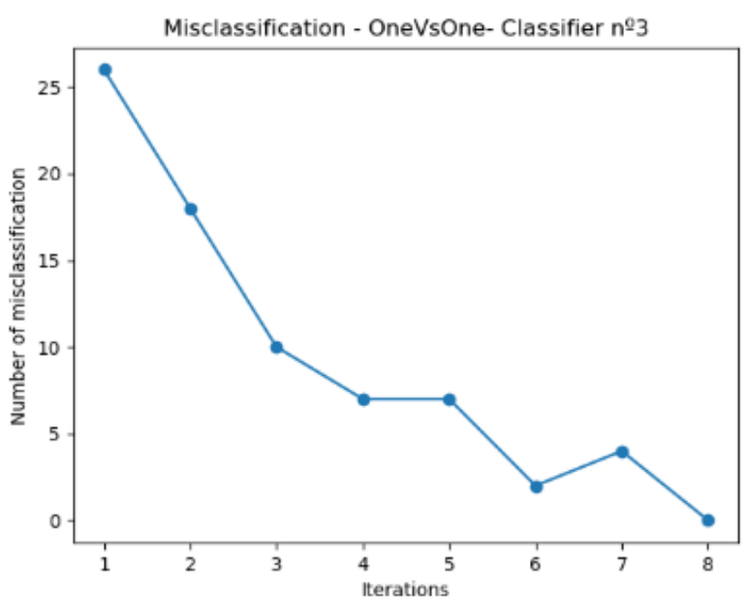

Figura 28: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

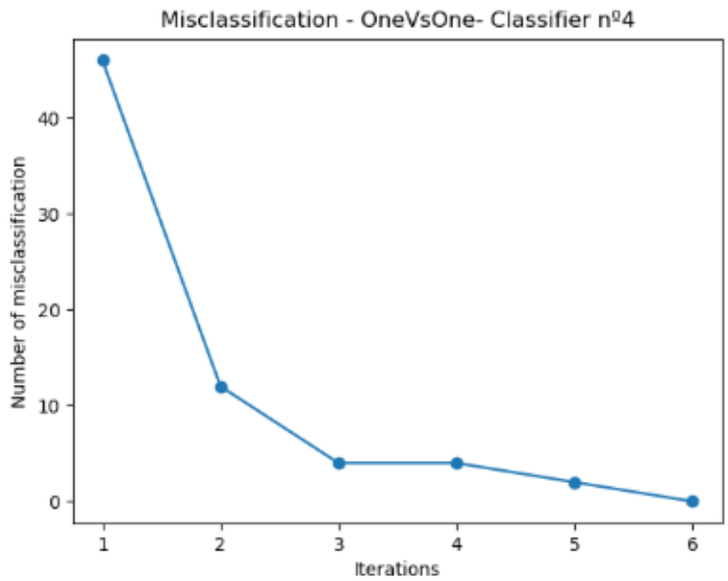

Figura 29: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

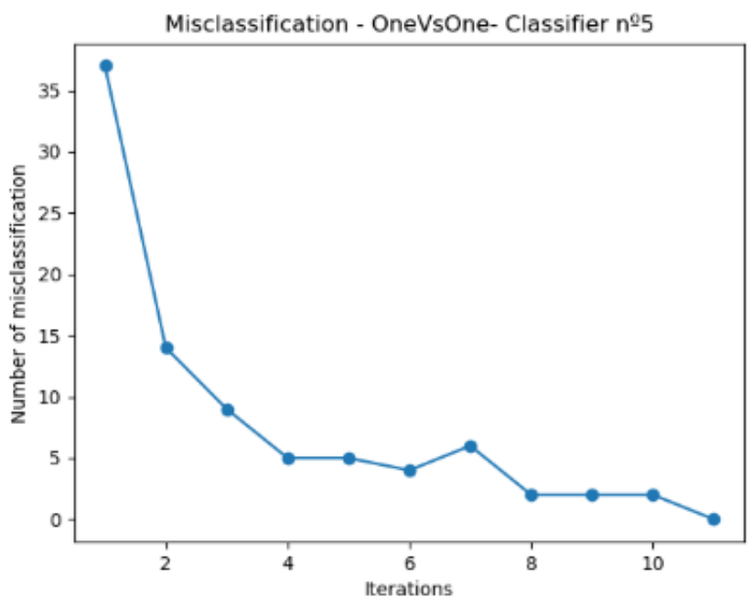

Figura 30: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

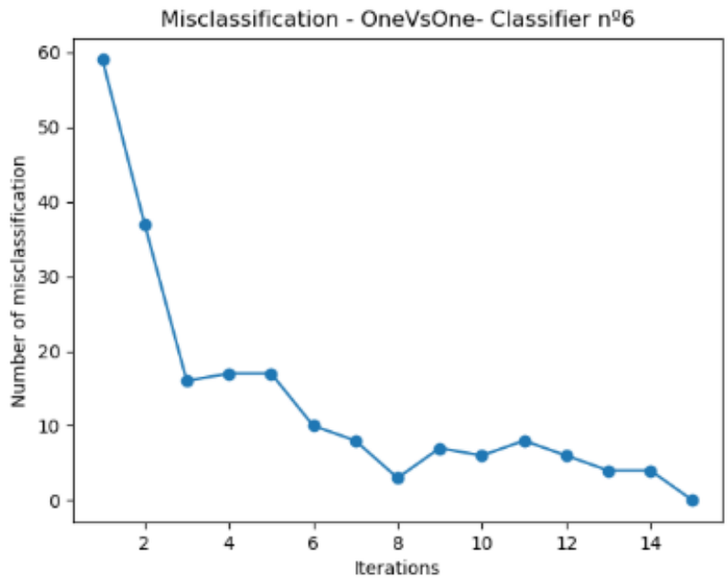

Figura 31: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

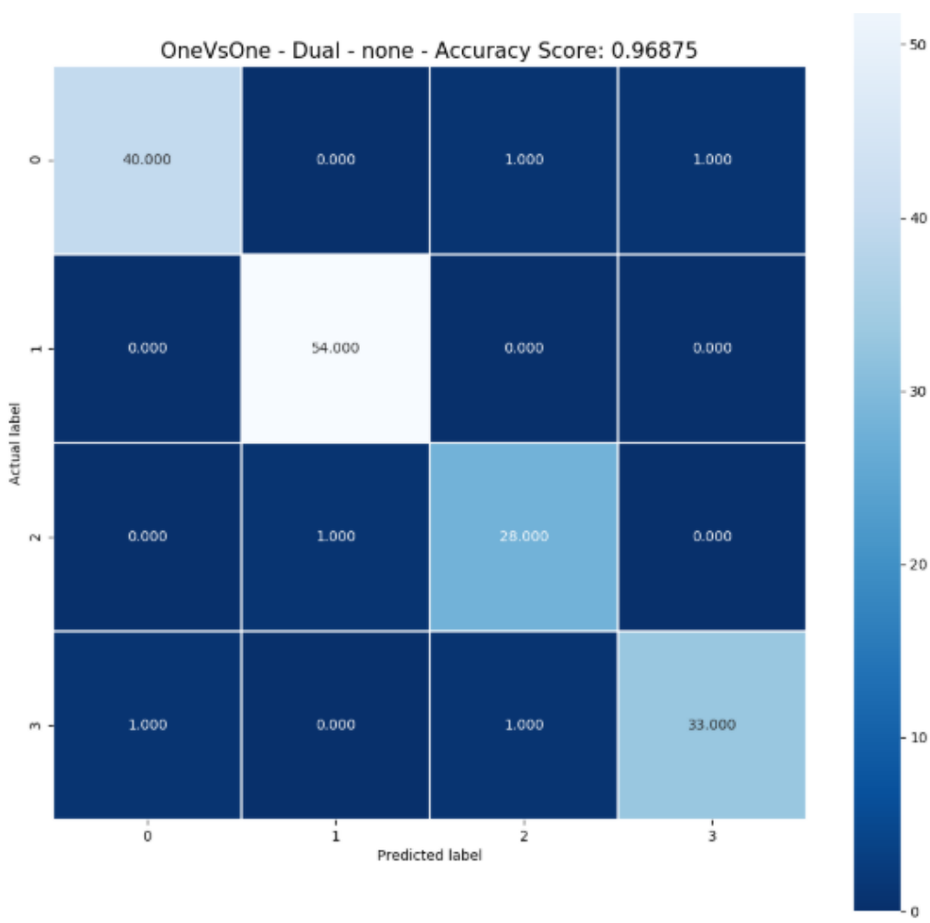

Figura 32: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

1.6 *Perceptron* Dual com *ECOC*

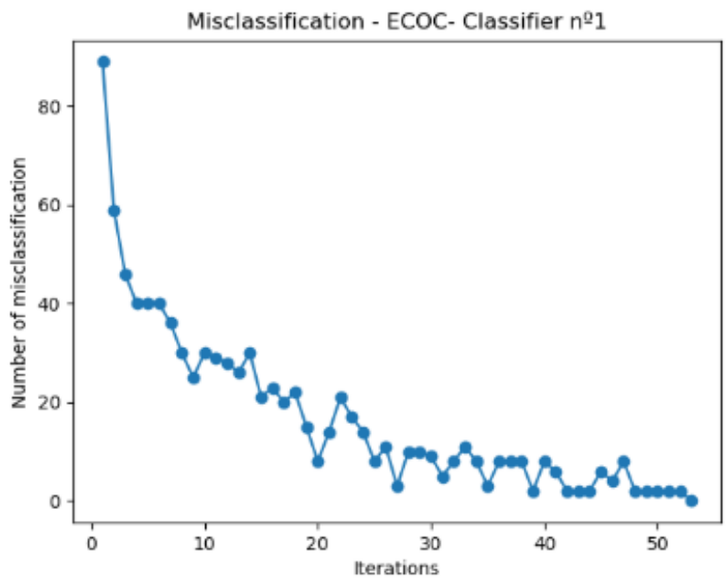

Figura 33: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

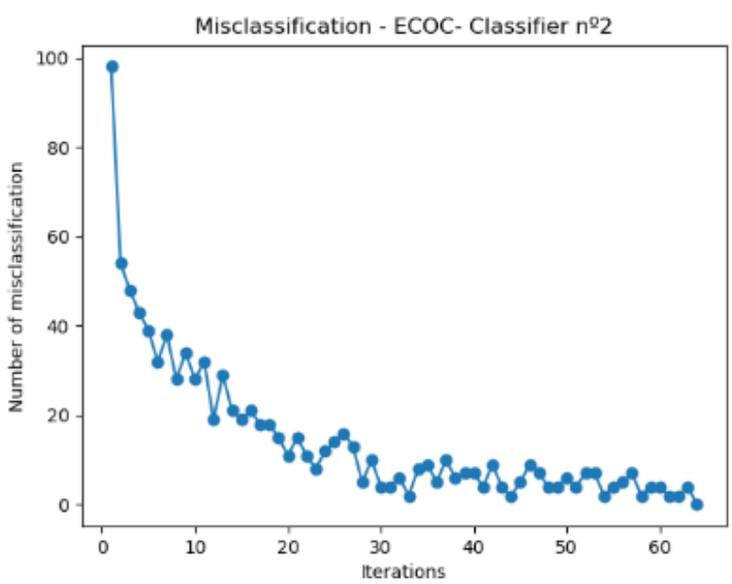

Figura 34: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

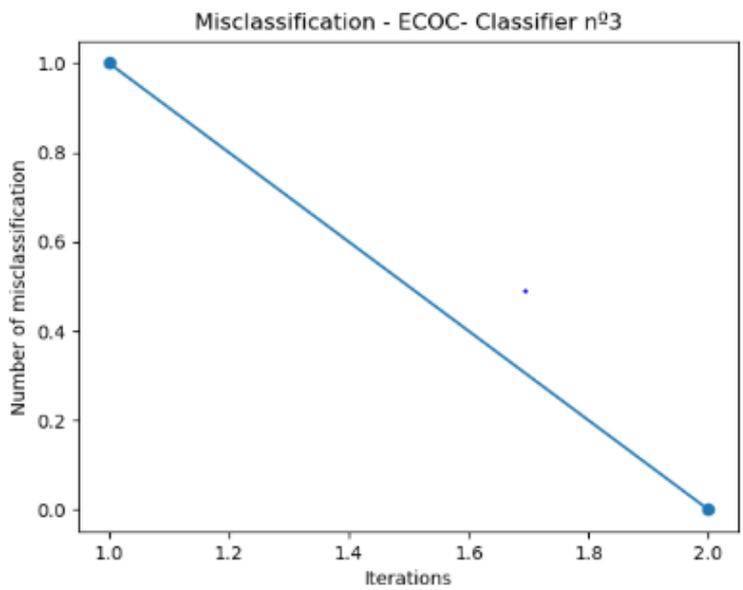

Figura 35: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

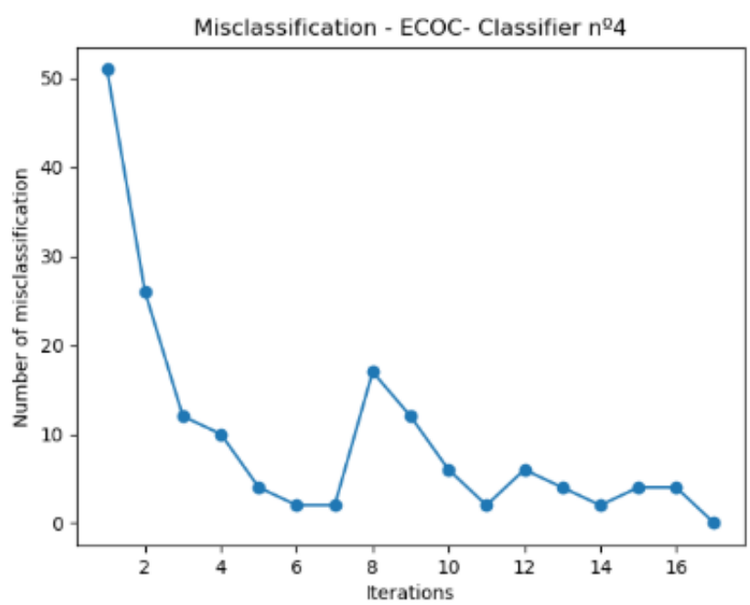

Figura 36: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

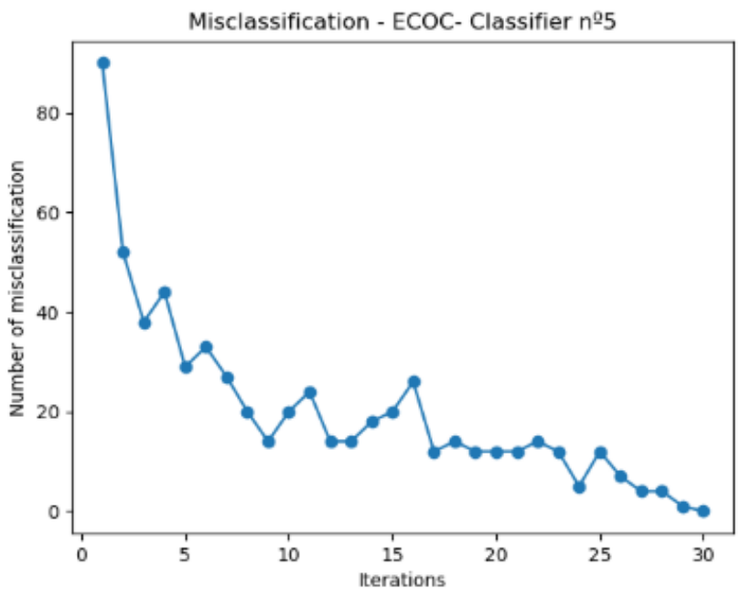

Figura 37: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

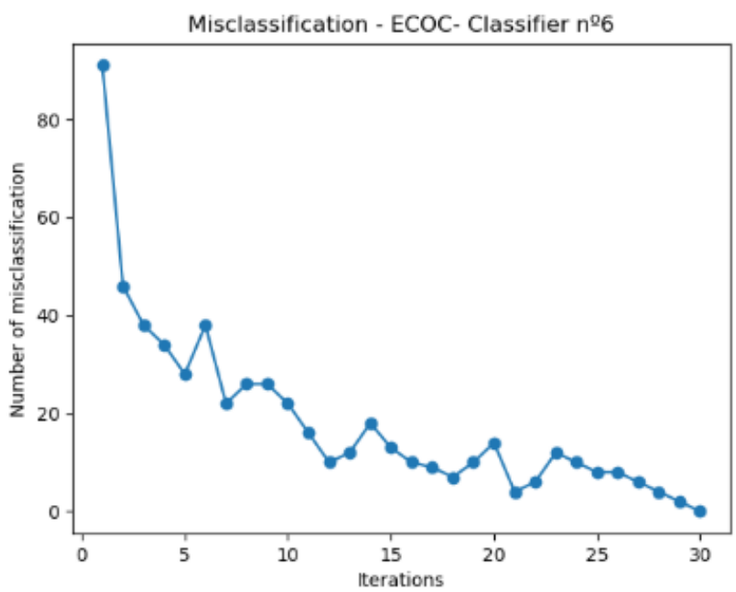

Figura 38: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

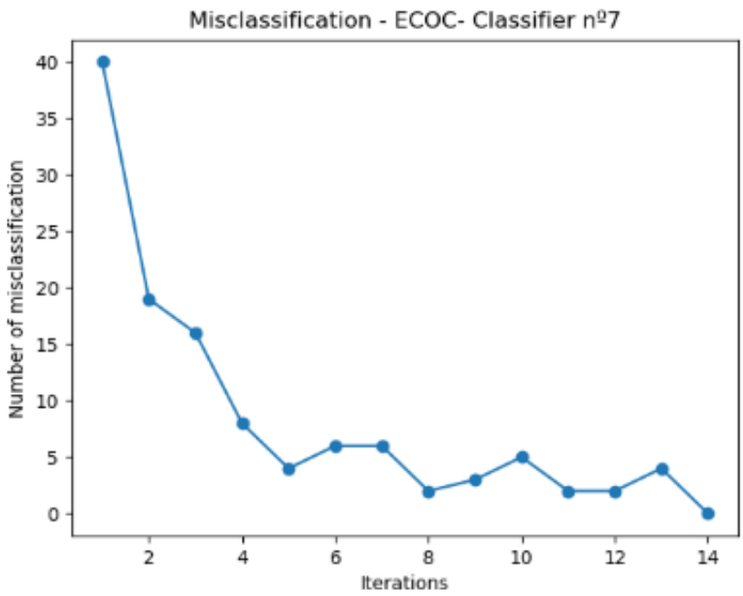

Figura 39: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

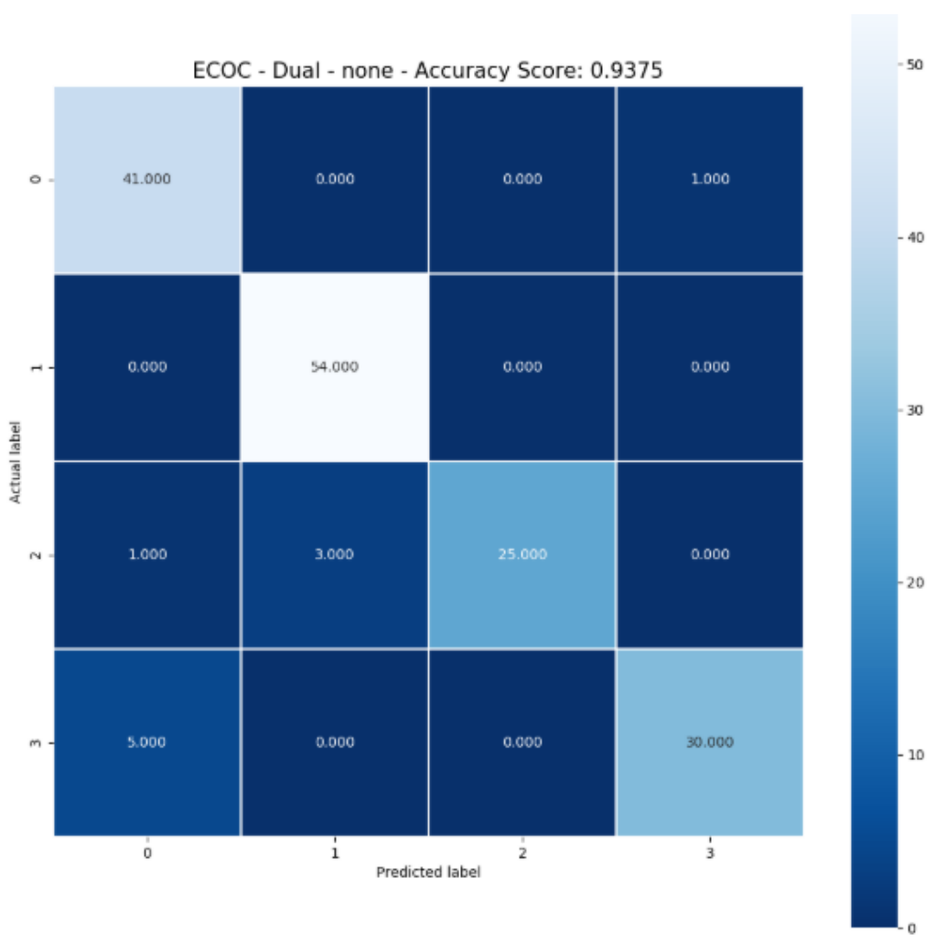

Figura 40: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

1.7 *Perceptron* Dual com *Kernel RBF* com *OVA*

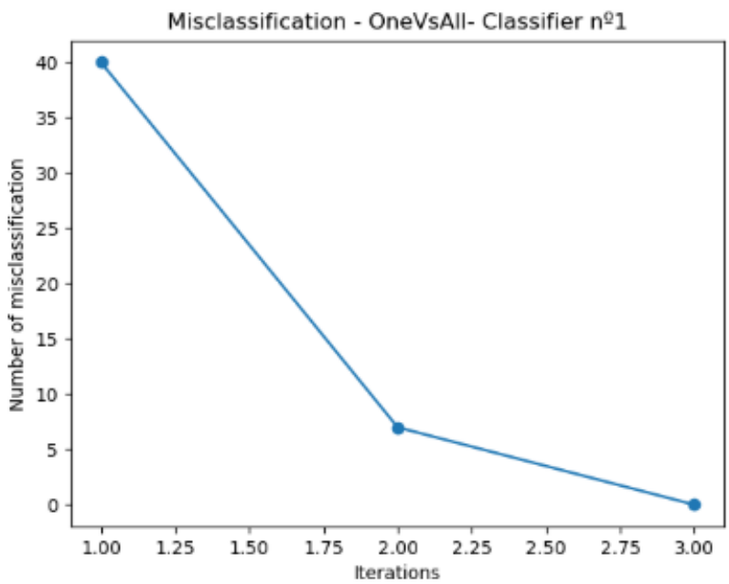

Figura 41: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

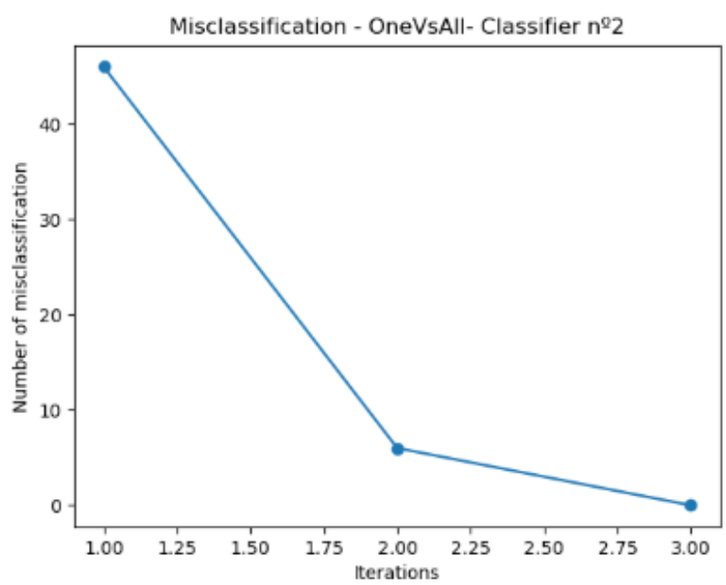

Figura 42: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

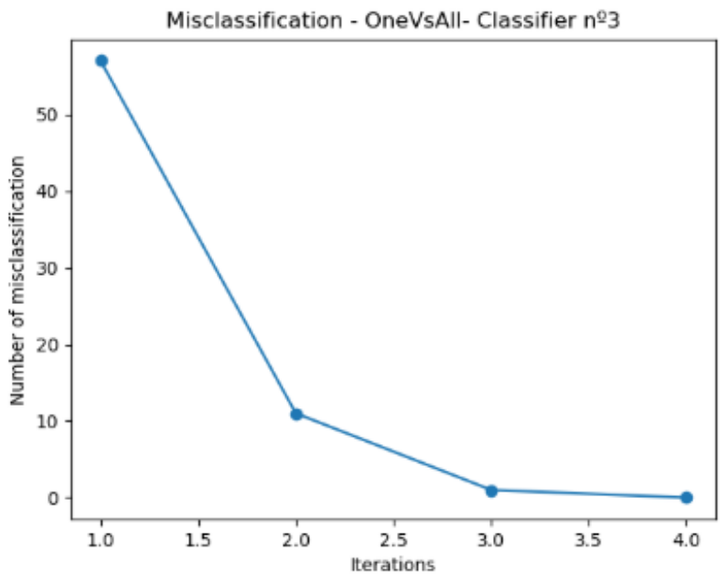

Figura 43: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

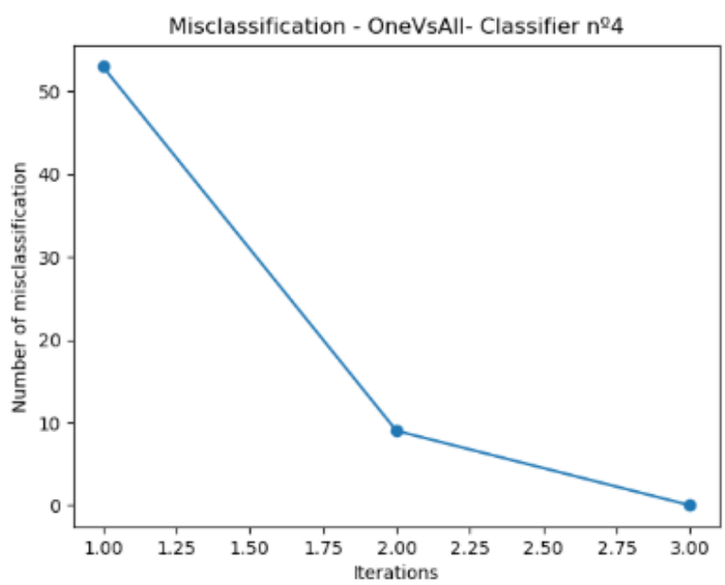

Figura 44: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

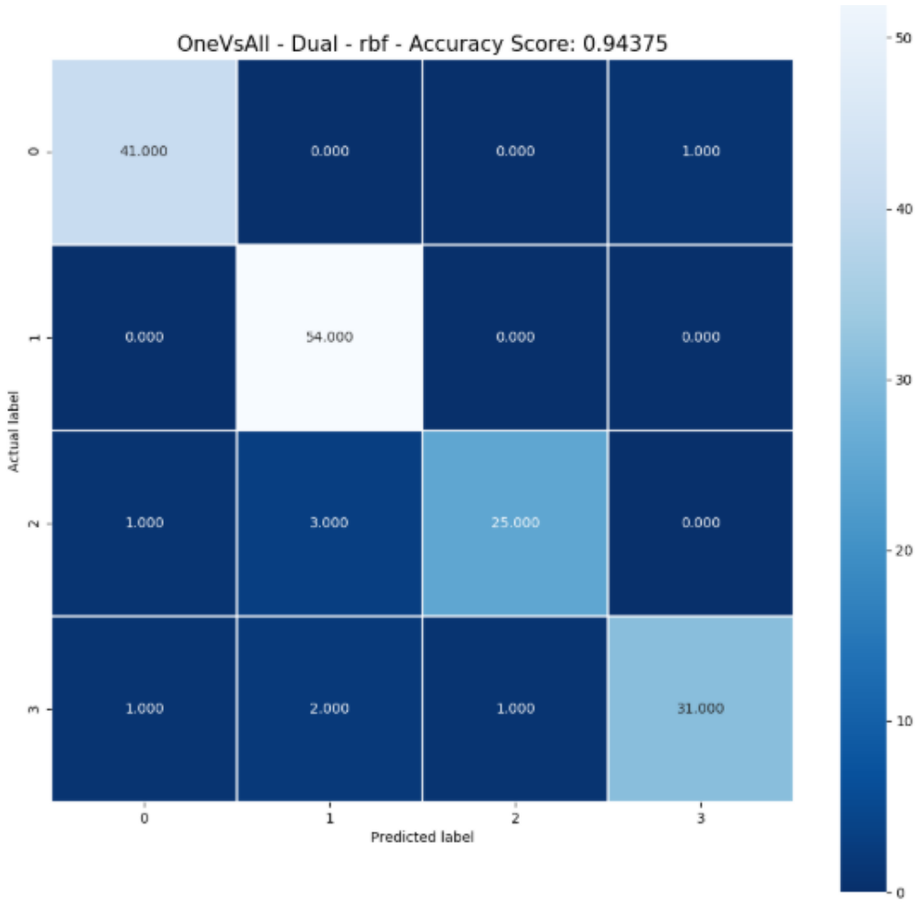

Figura 45: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

1.8 *Perceptron* Dual com *Kernel RBF* com *OVO*

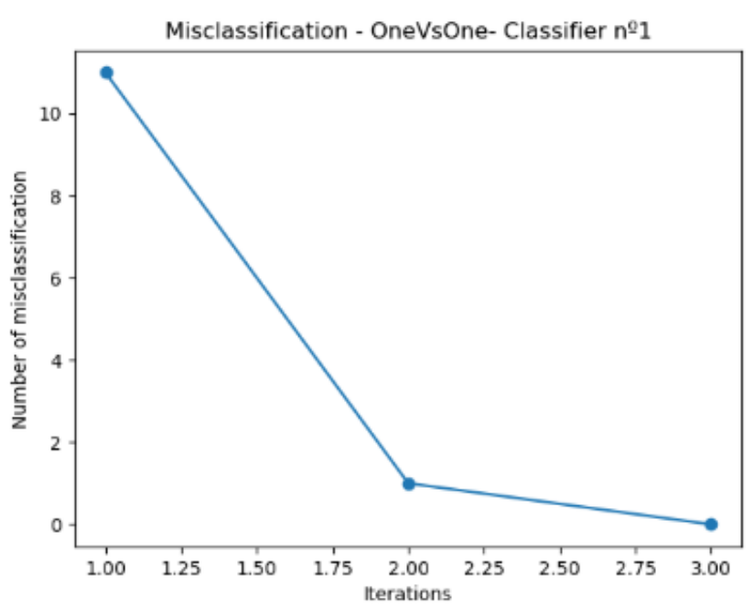

Figura 46: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

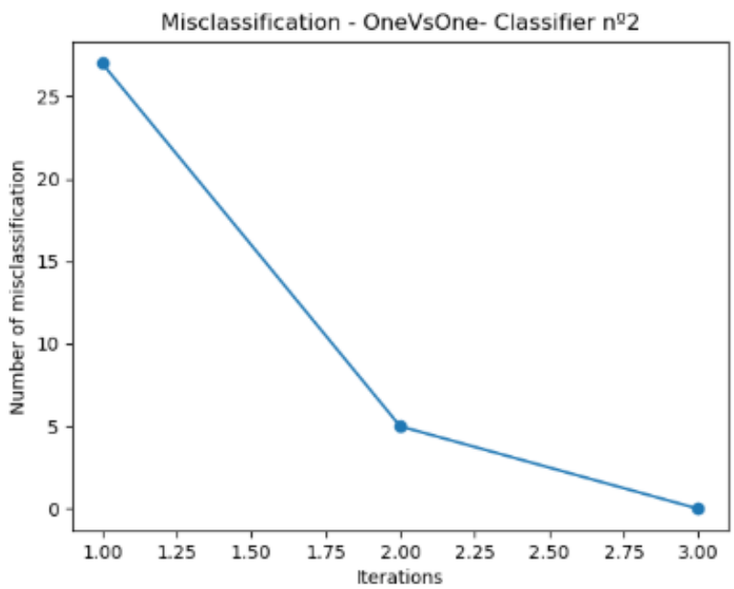

Figura 47: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

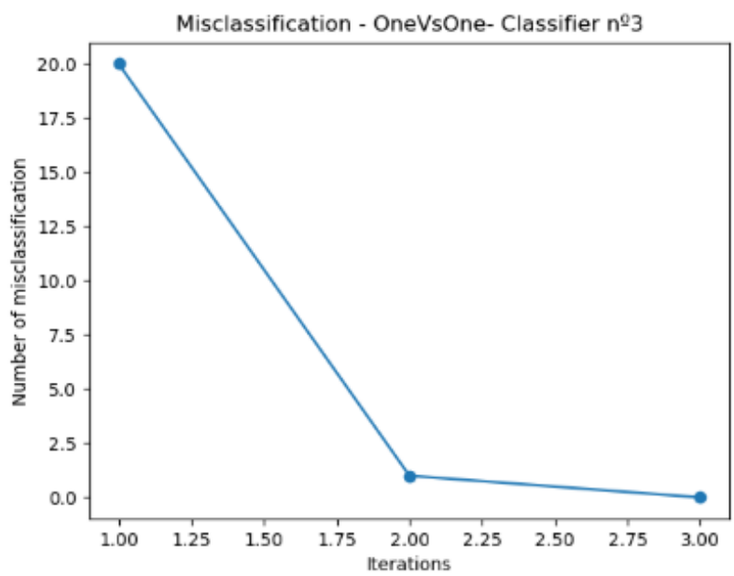

Figura 48: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

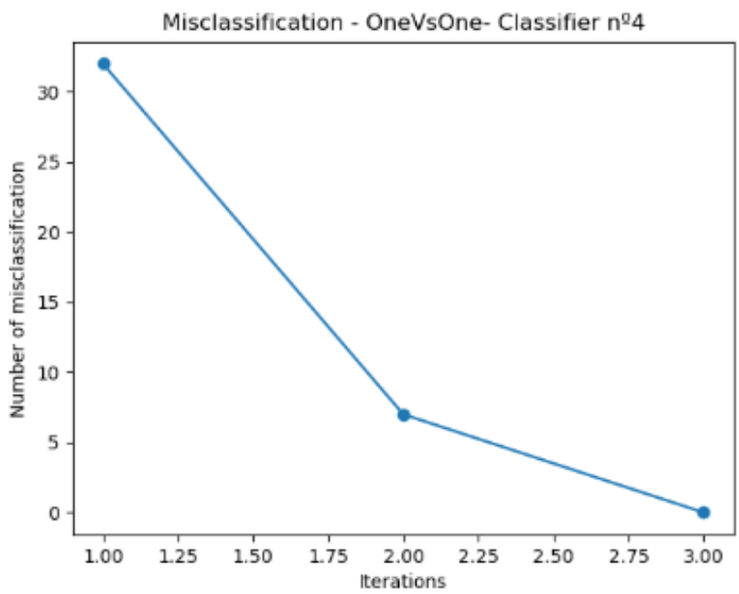

Figura 49: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

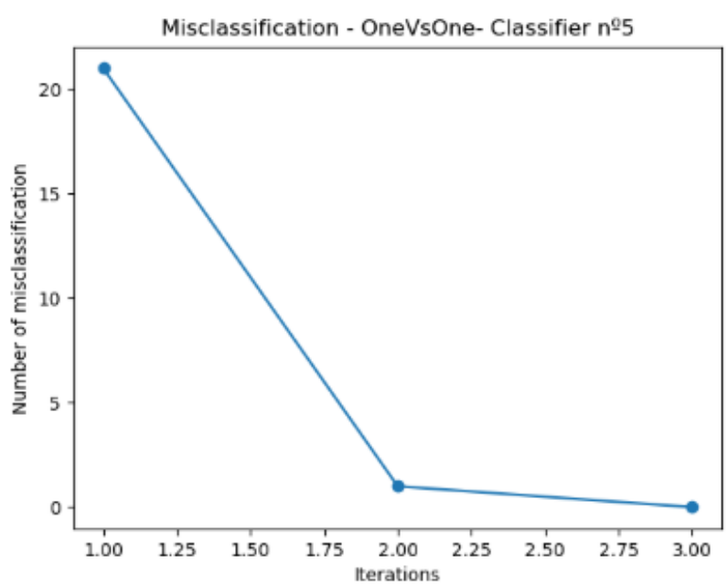

Figura 50: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

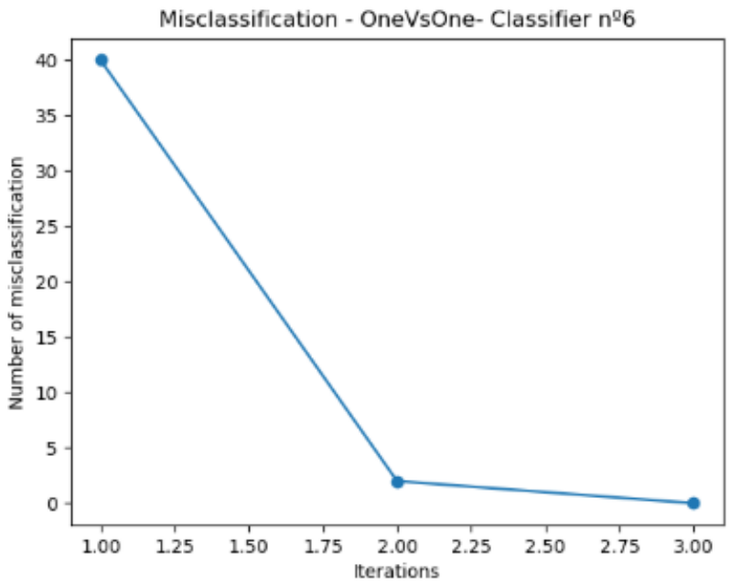

Figura 51: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

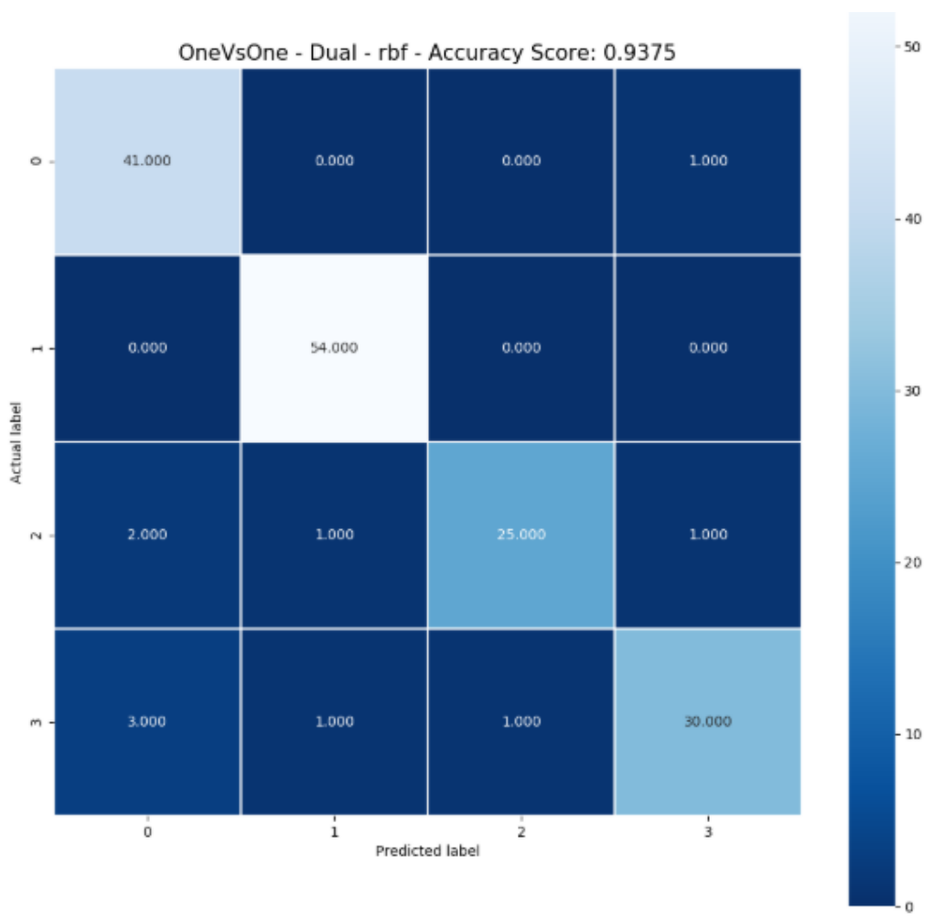

Figura 52: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

1.9 *Perceptron* Dual com *Kernel RBF* com *ECOC*

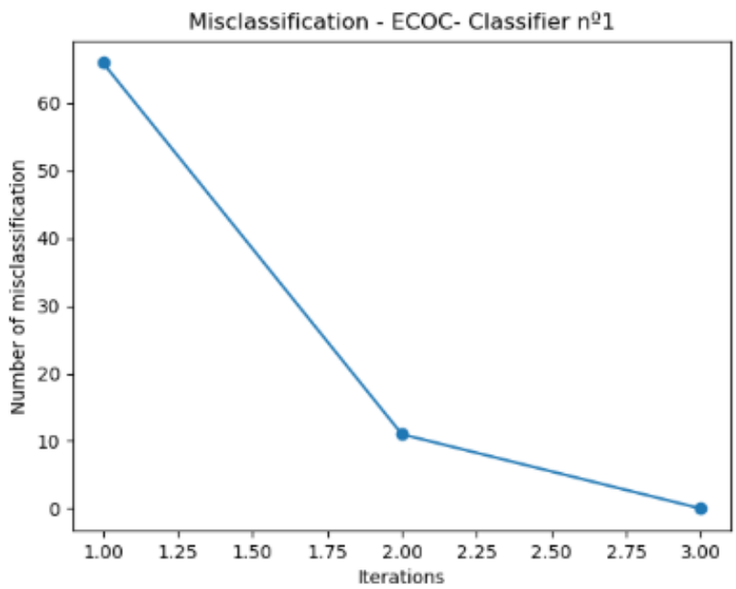

Figura 53: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

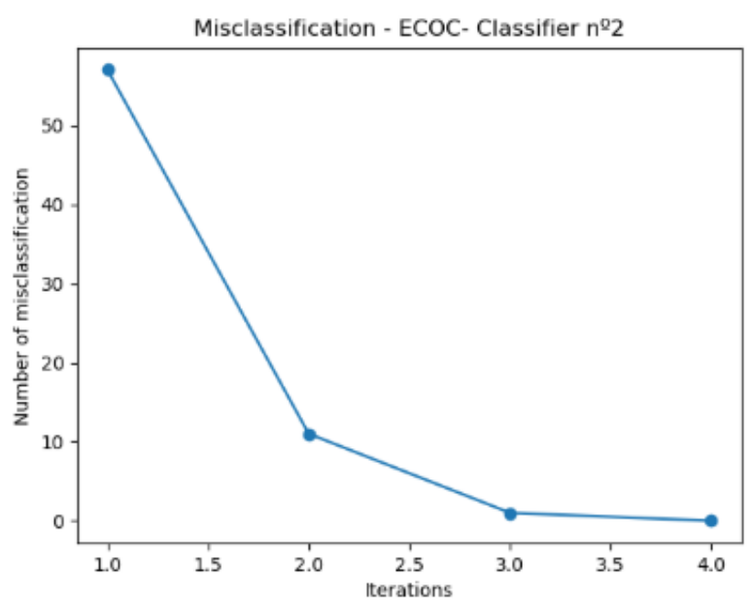

Figura 54: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

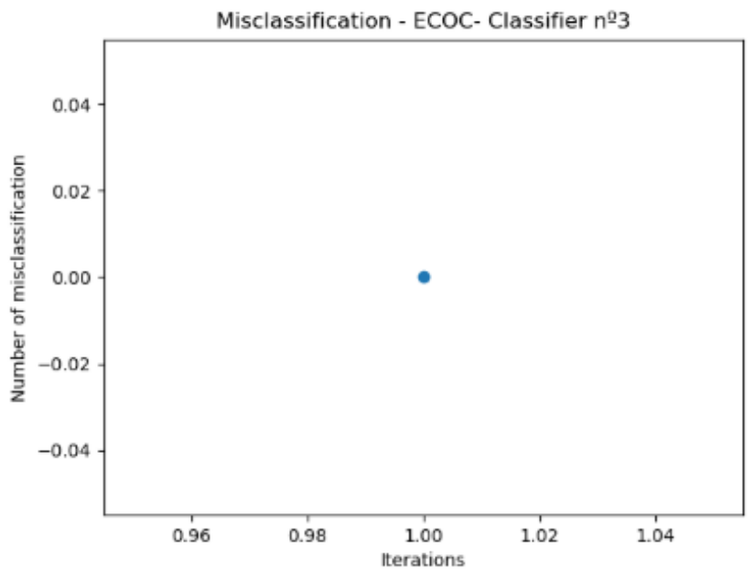

Figura 55: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

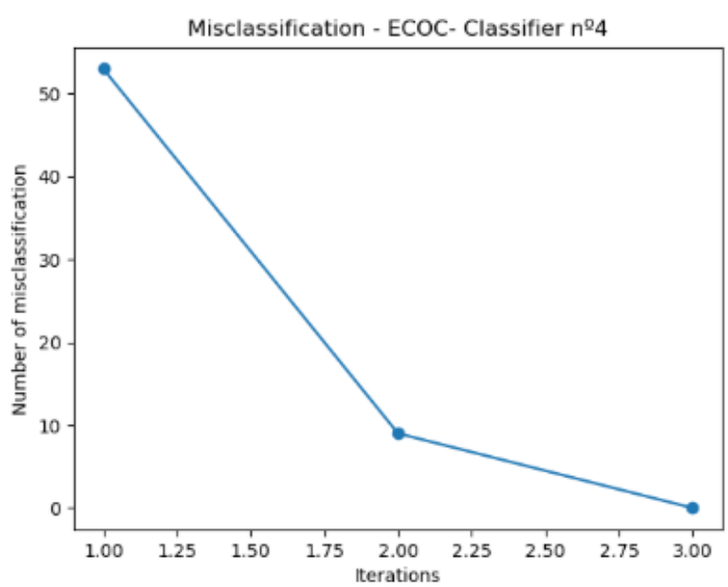

Figura 56: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

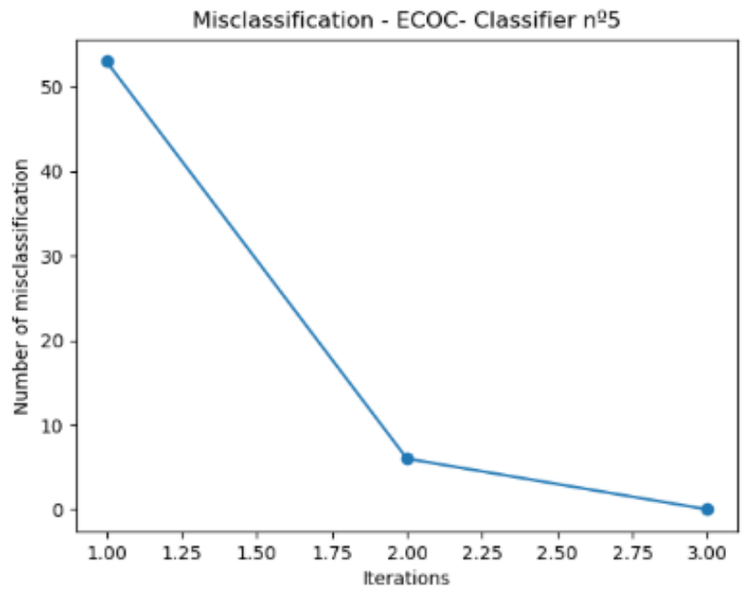

Figura 57: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

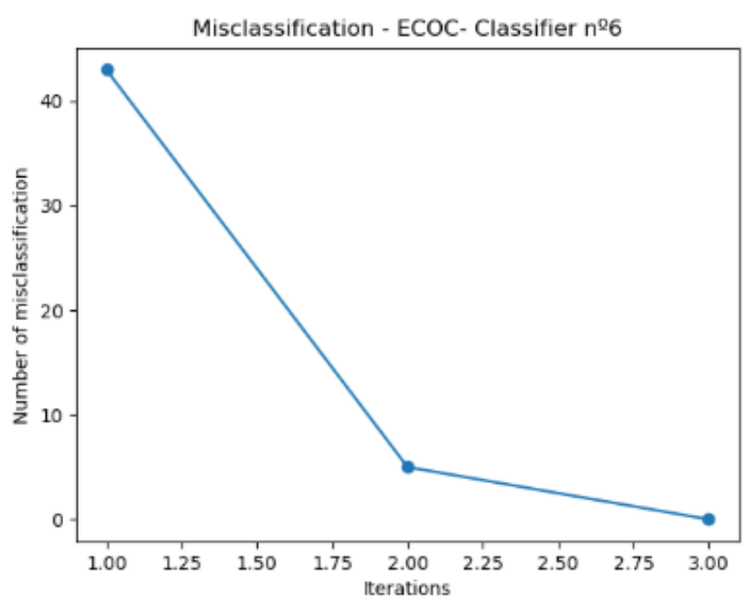

Figura 58: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

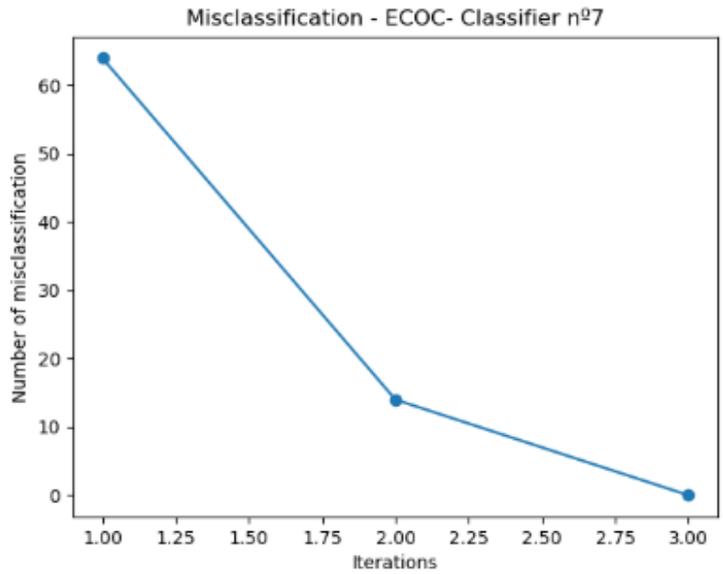

Figura 59: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

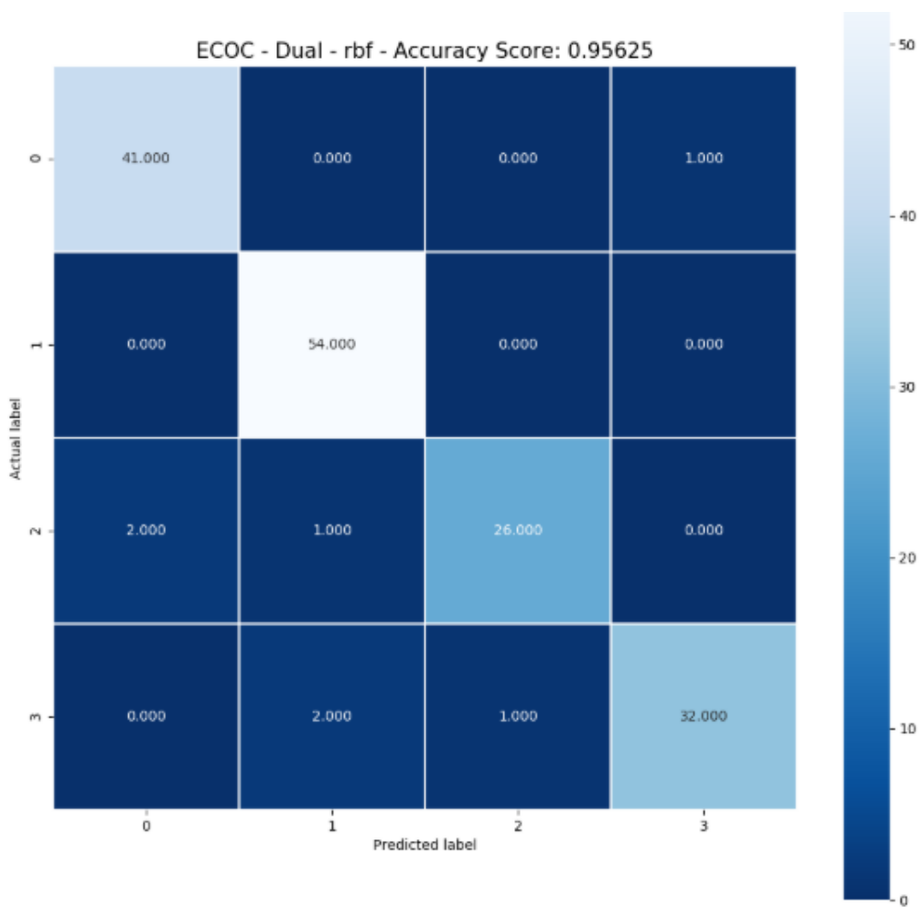

Figura 60: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

1.10 *Perceptron* Dual com *Kernel* Polinomial com *OVA*

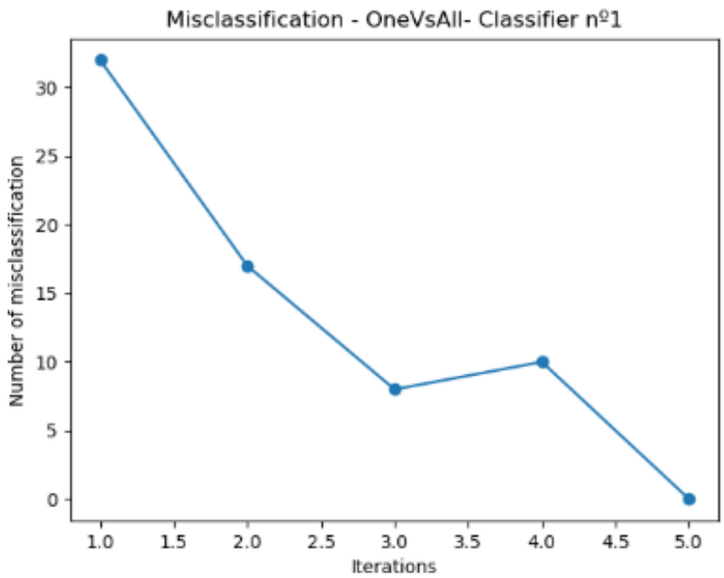

Figura 61: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

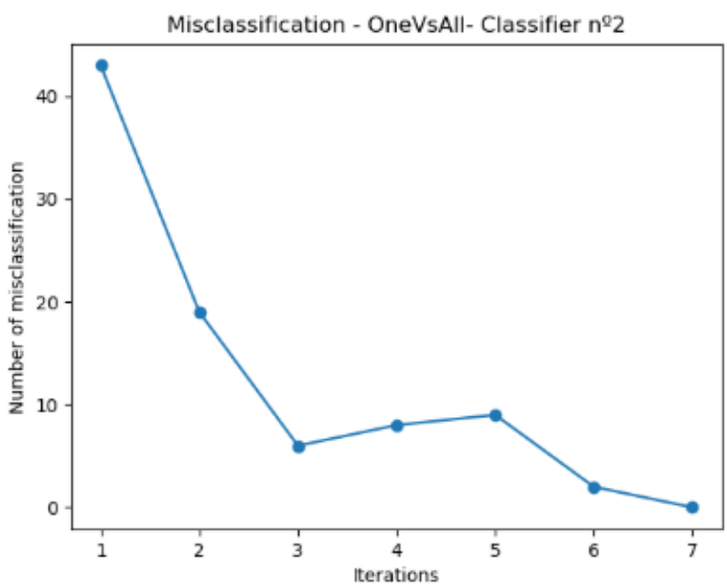

Figura 62: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

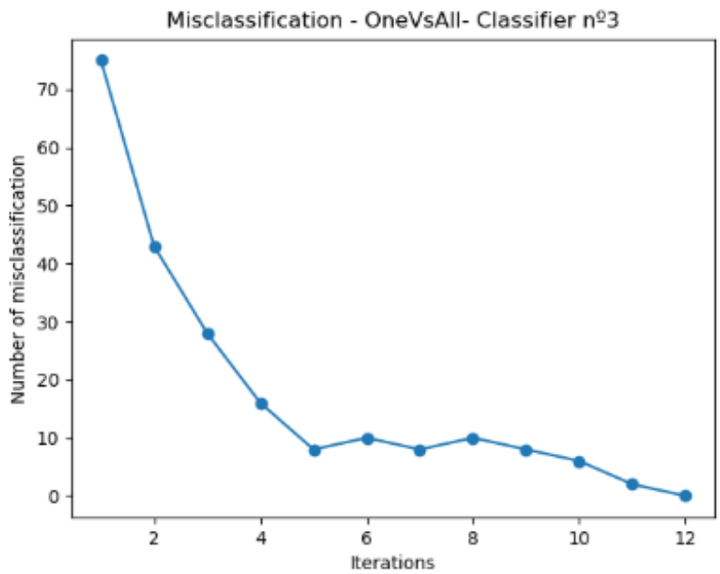

Figura 63: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

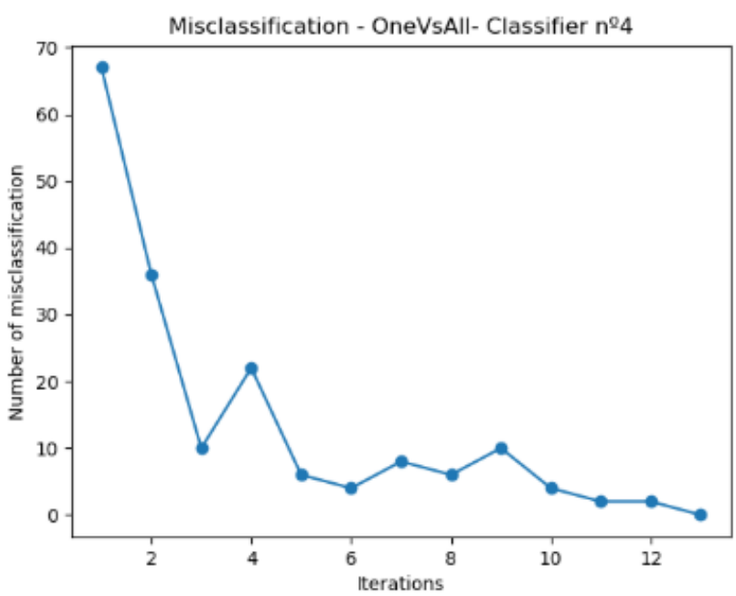

Figura 64: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

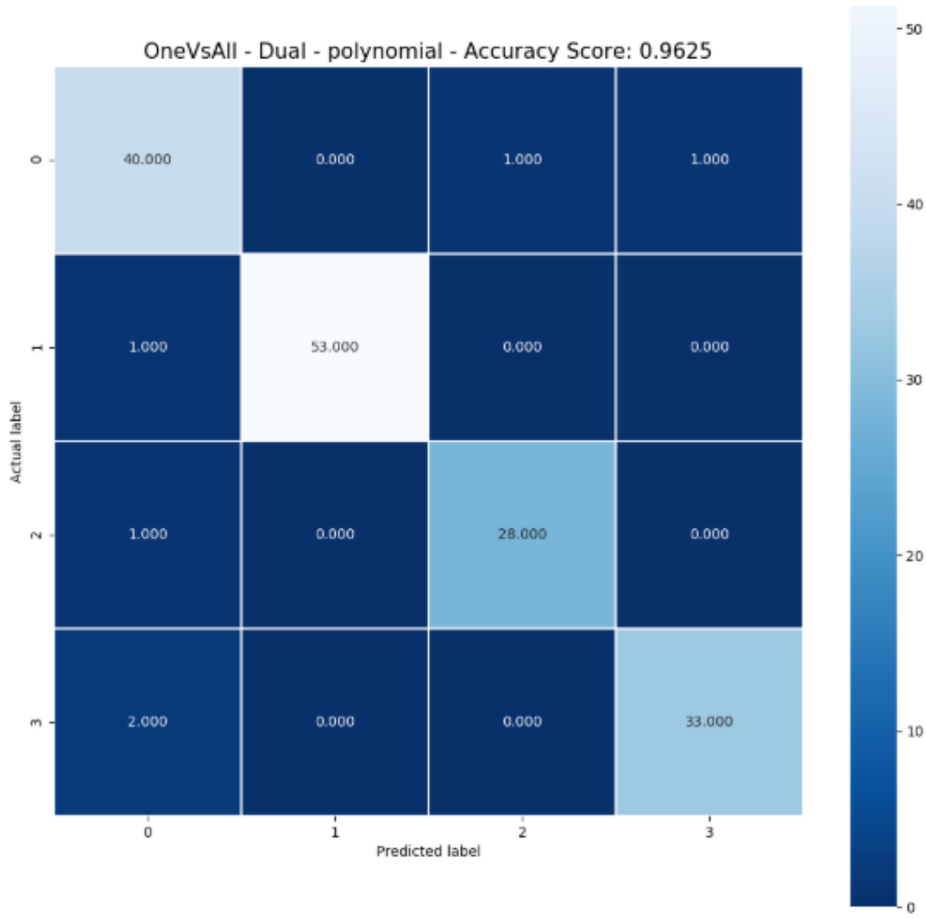

Figura 65: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

1.11 *Perceptron* Dual com *Kernel* Polinomial com *OVO*

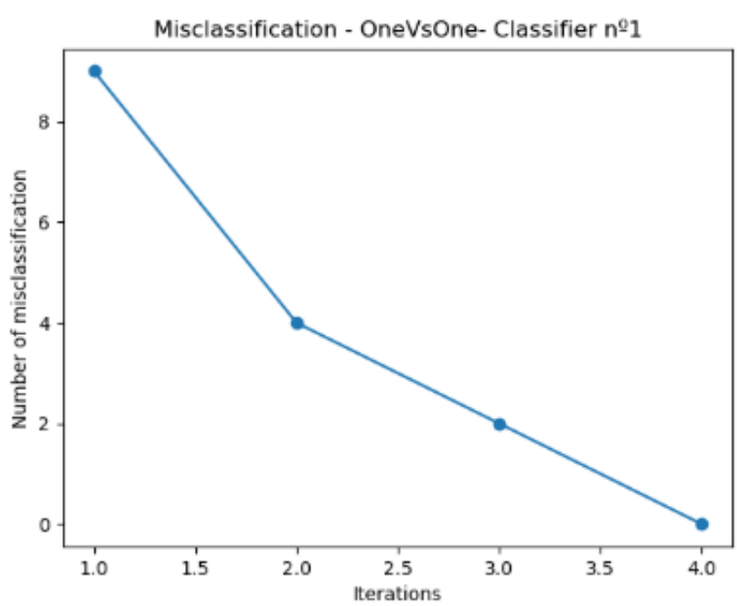

Figura 66: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

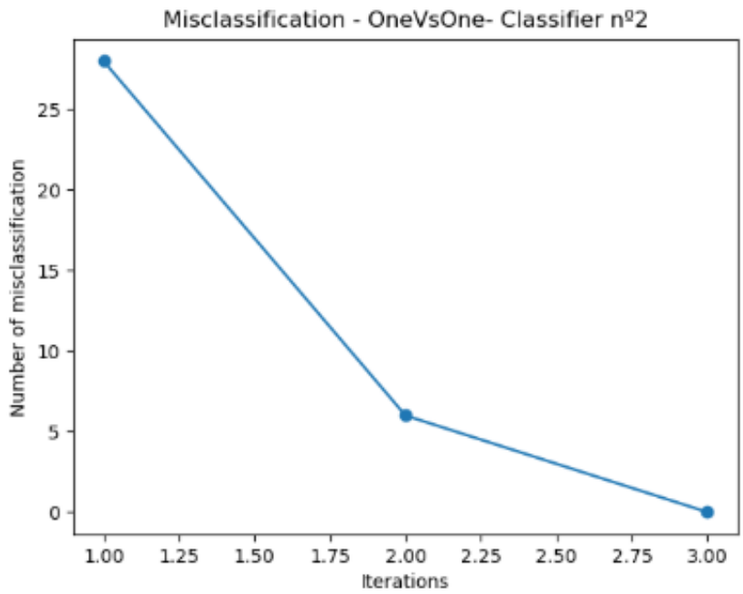

Figura 67: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

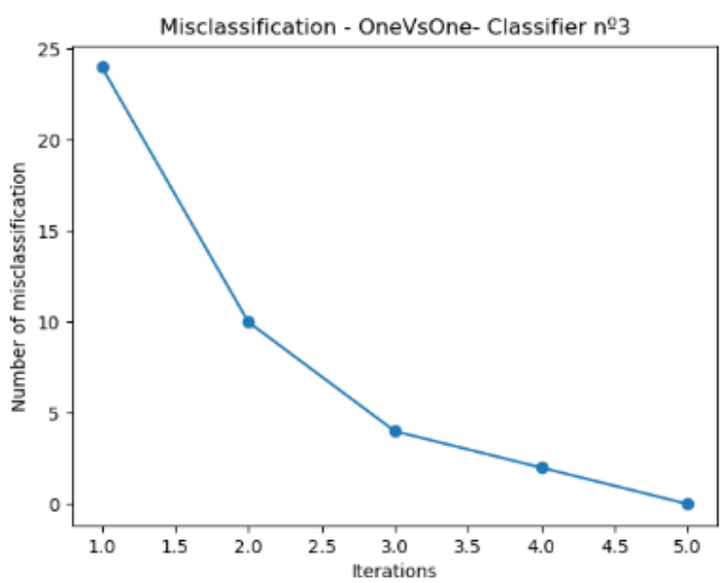

Figura 68: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

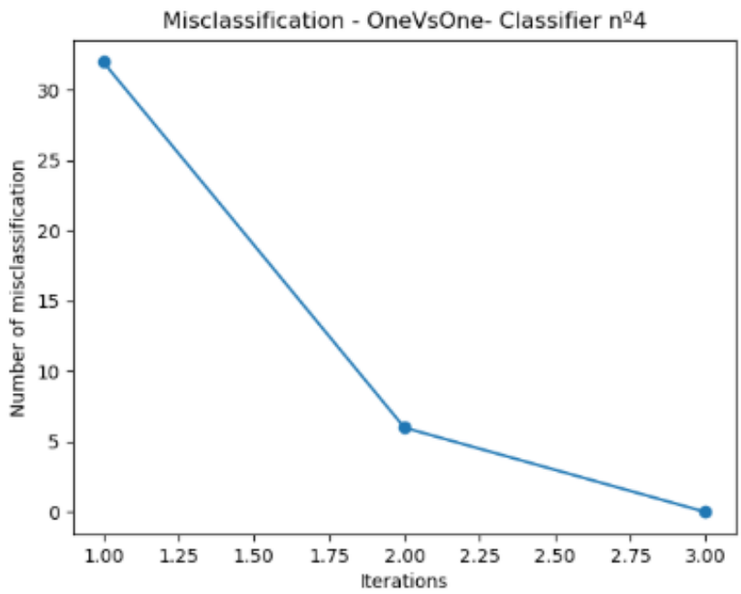

Figura 69: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

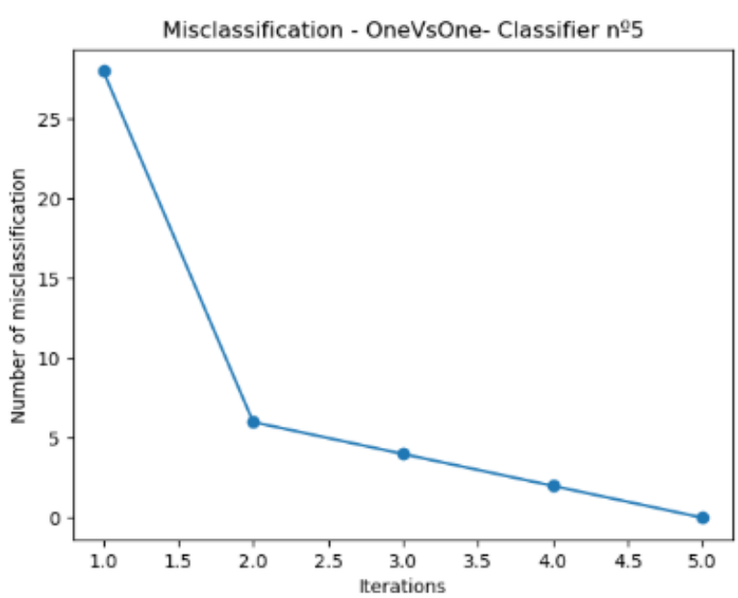

Figura 70: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

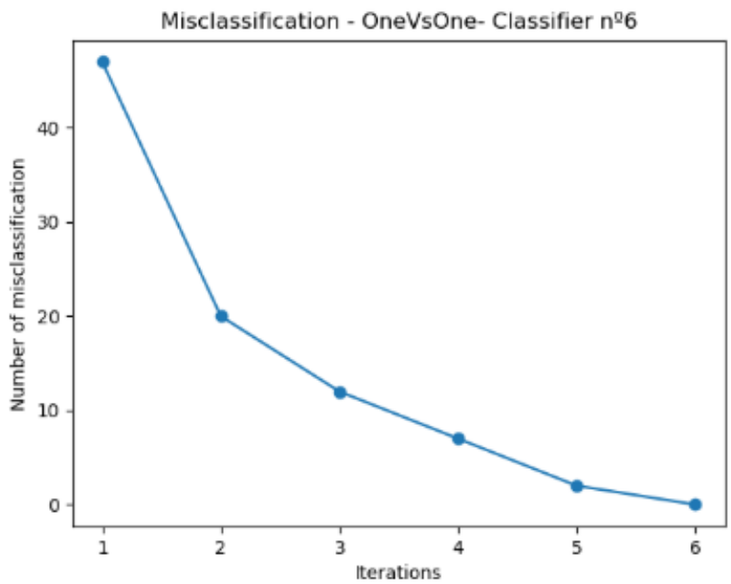

Figura 71: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

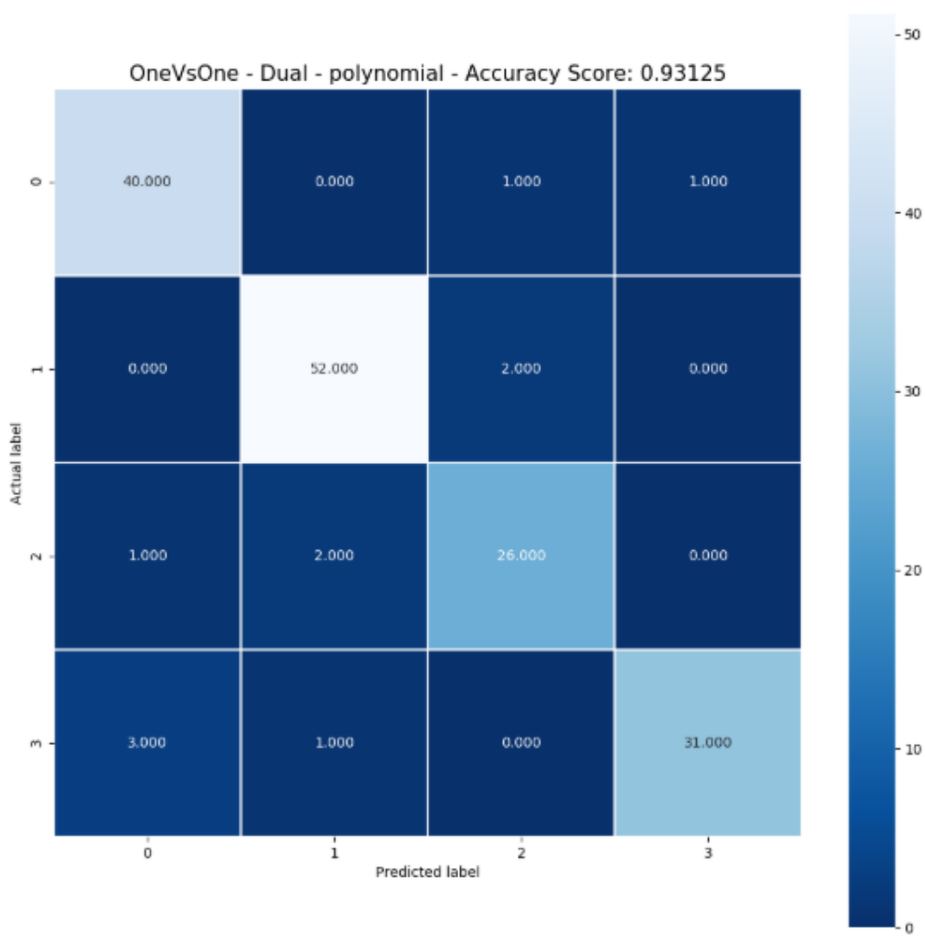

Figura 72: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

1.12 *Perceptron* Dual com *Kernel* Polinomial com *ECOC*

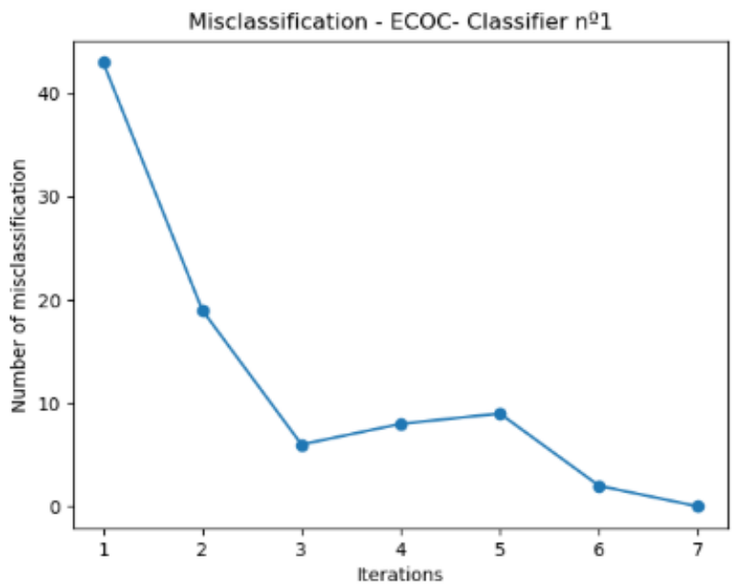

Figura 73: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

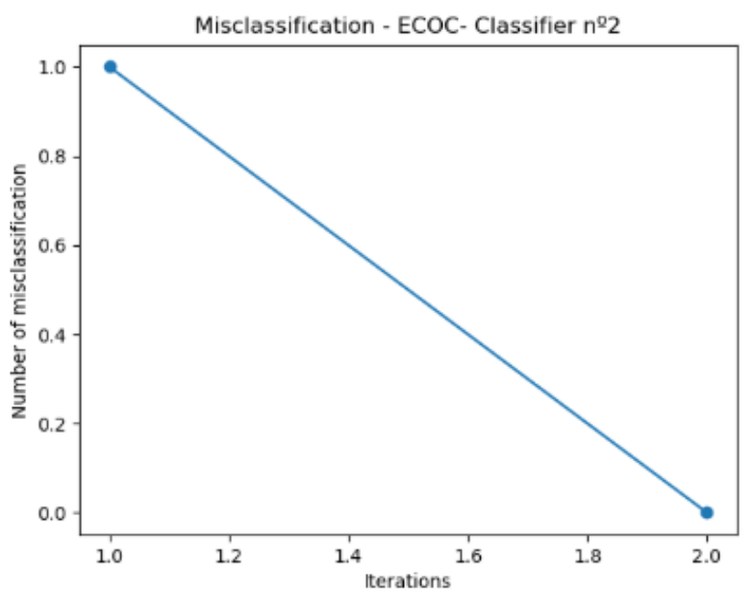

Figura 74: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

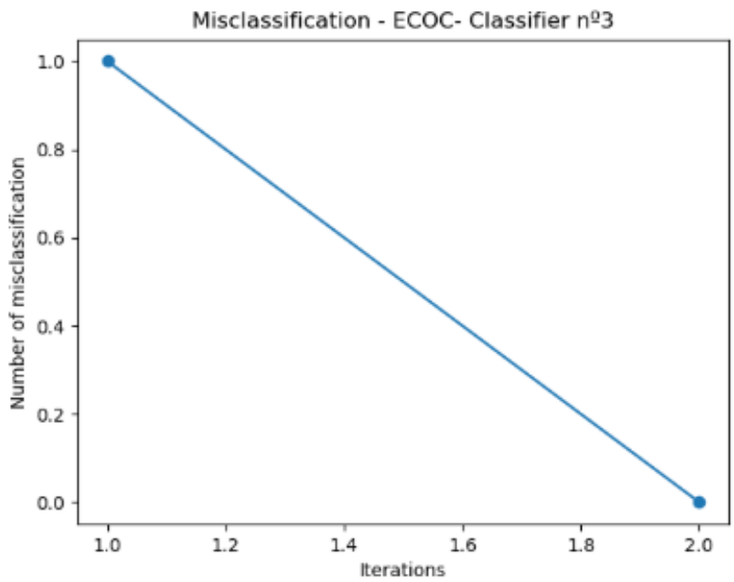

Figura 75: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

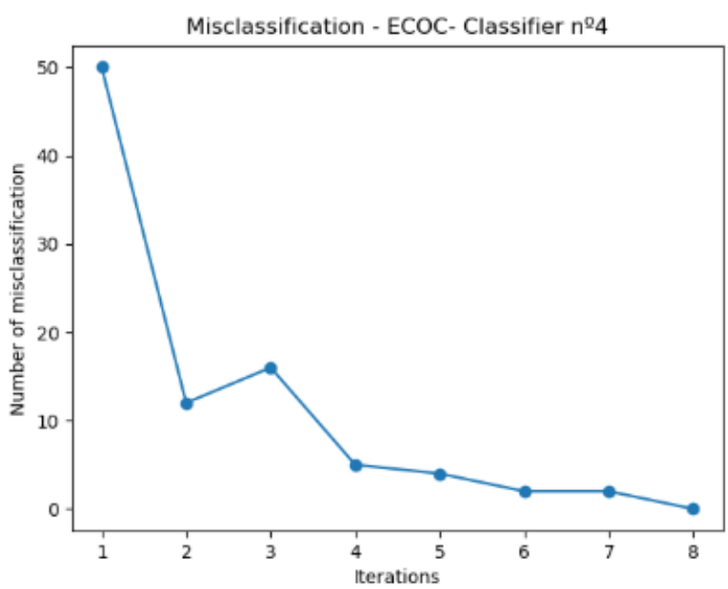

Figura 76: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

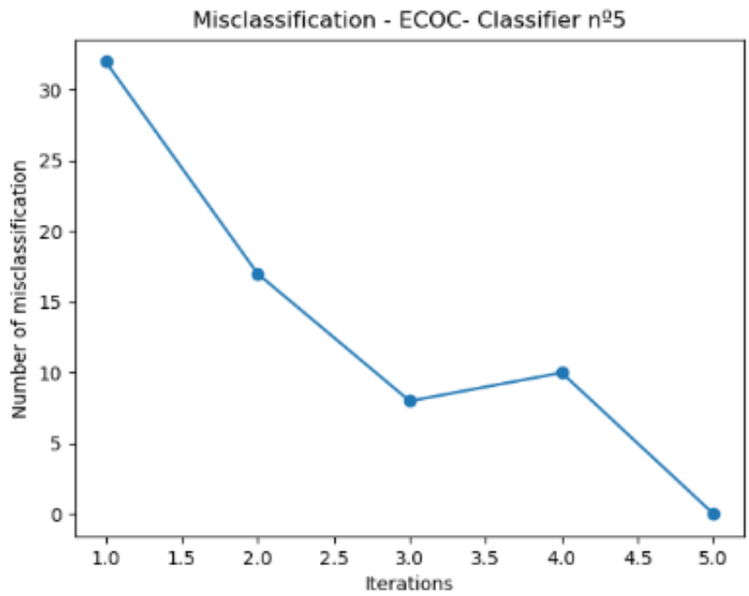

Figura 77: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

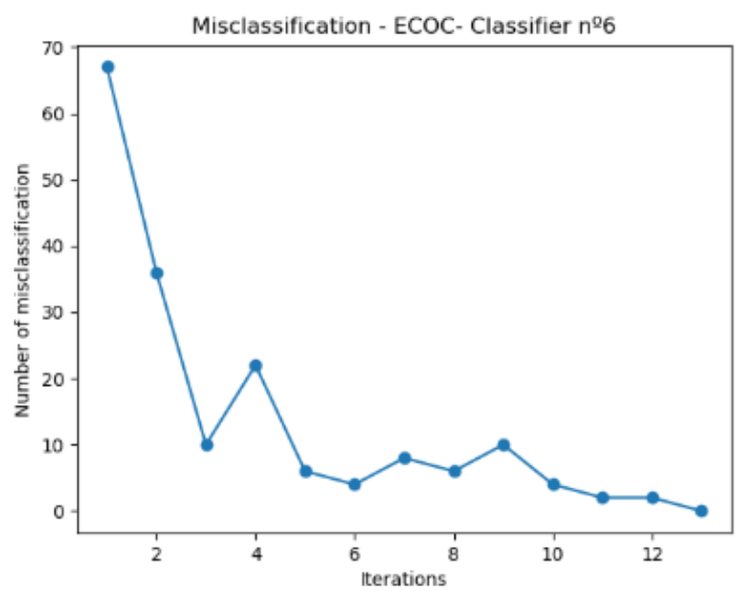

Figura 78: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

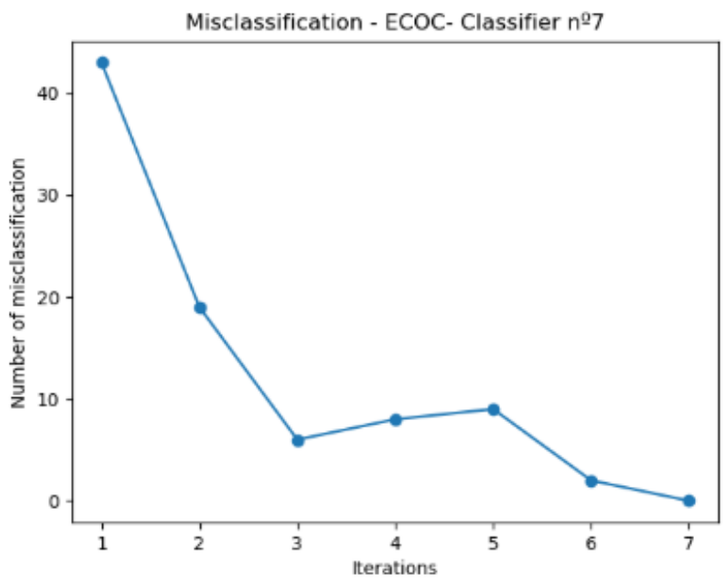

Figura 79: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

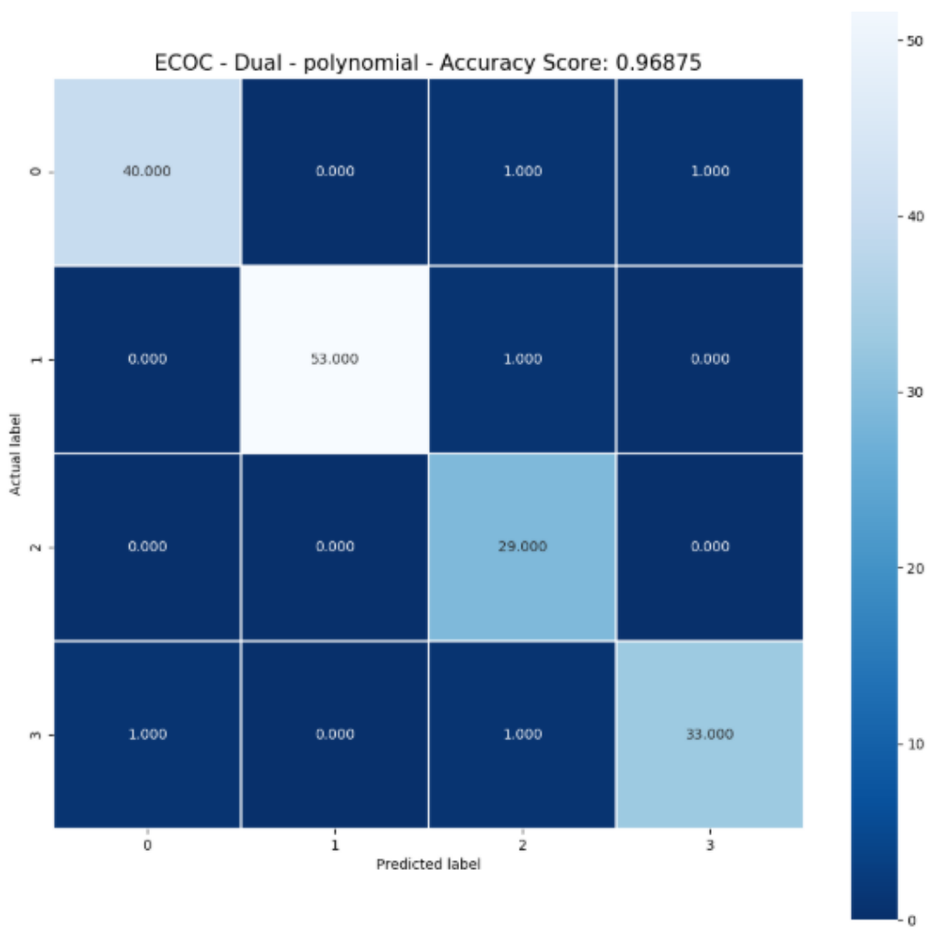

Figura 80: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

2 Resultados com *Dataset Digits* para as classes 0123

2.1 *Perceptron* Primal com *OVA*

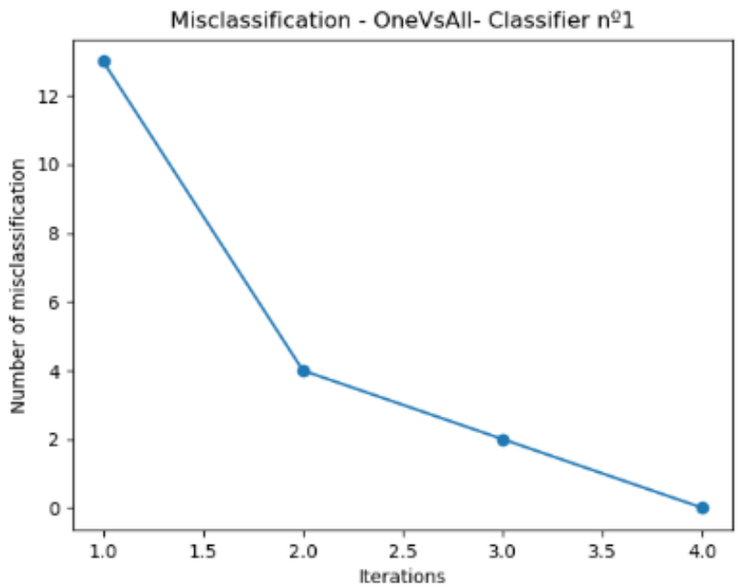

Figura 81: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

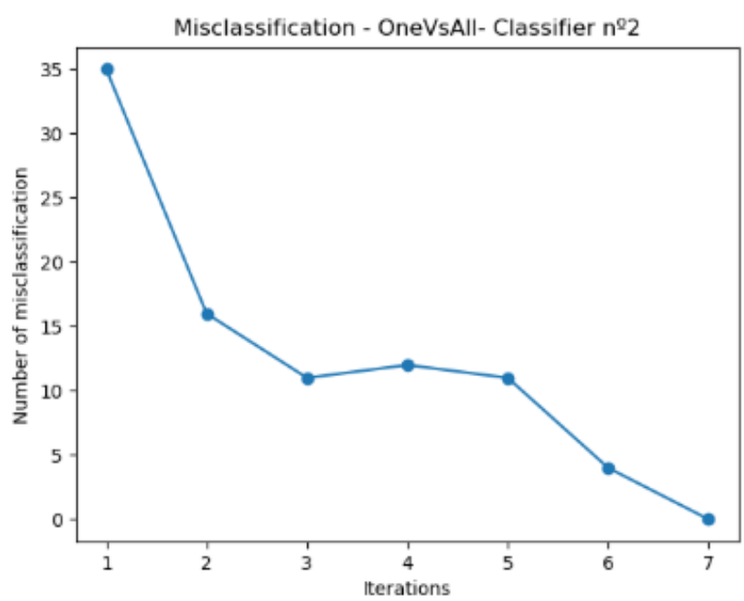

Figura 82: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

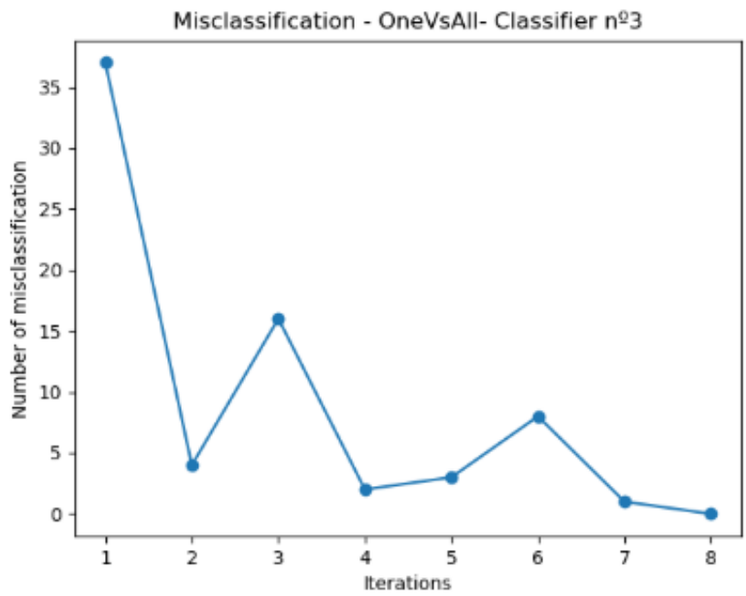

Figura 83: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

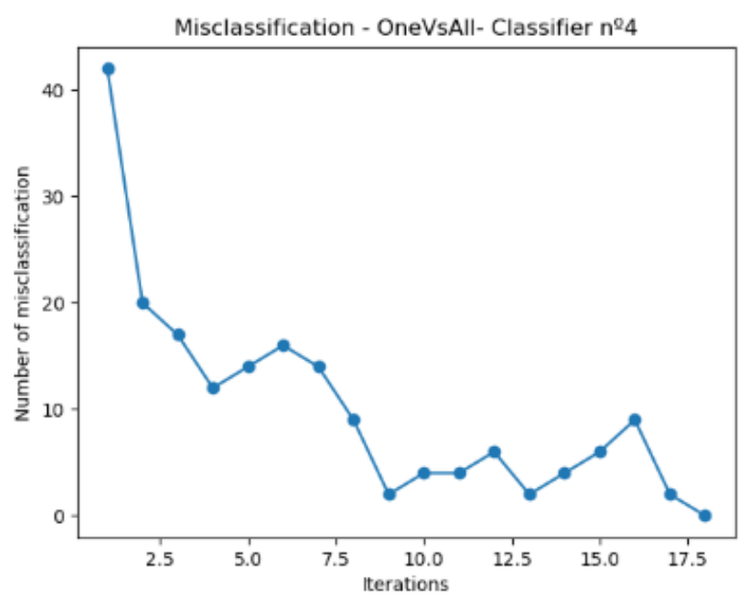

Figura 84: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

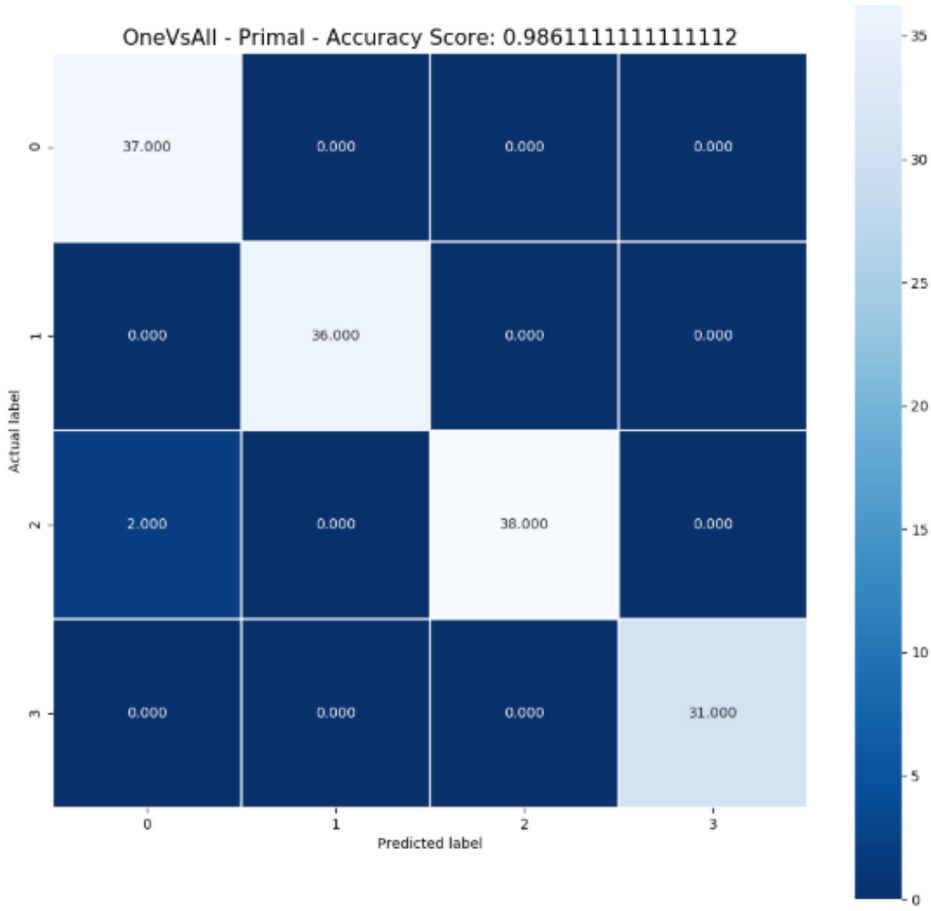

Figura 85: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

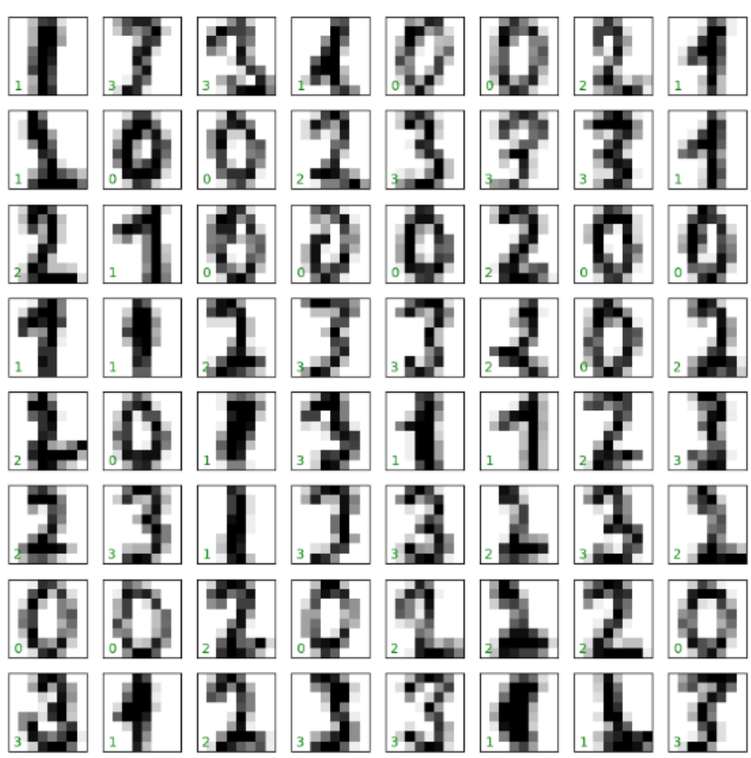

Figura 86: *OneVsAll* — *Predictions* utilizando o *Dataset Digits*

2.2 *Perceptron* Primal com *OVO*

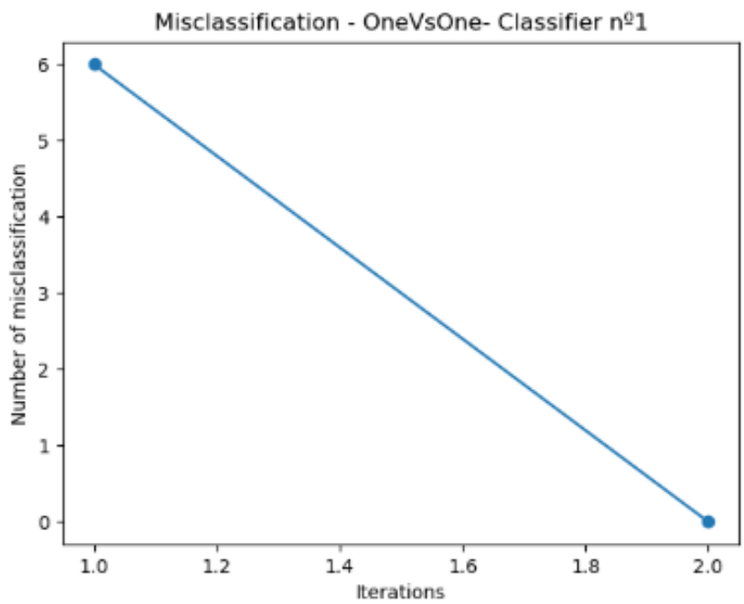

Figura 87: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

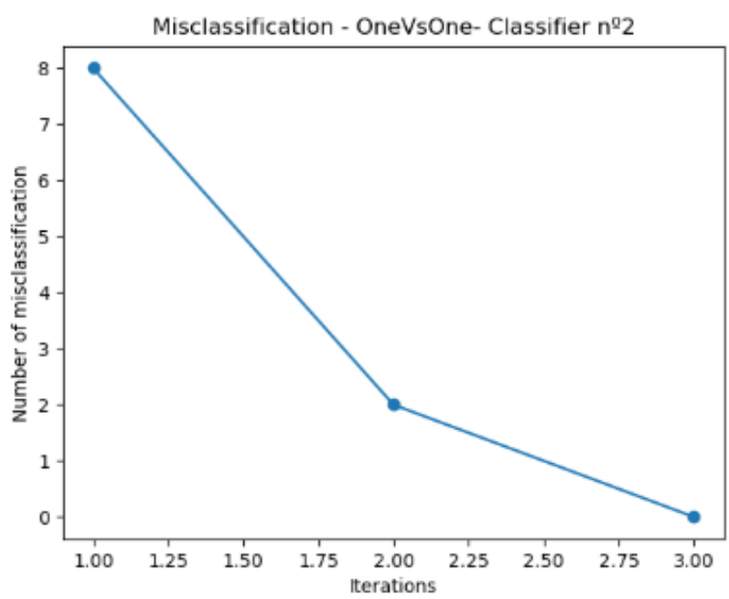

Figura 88: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

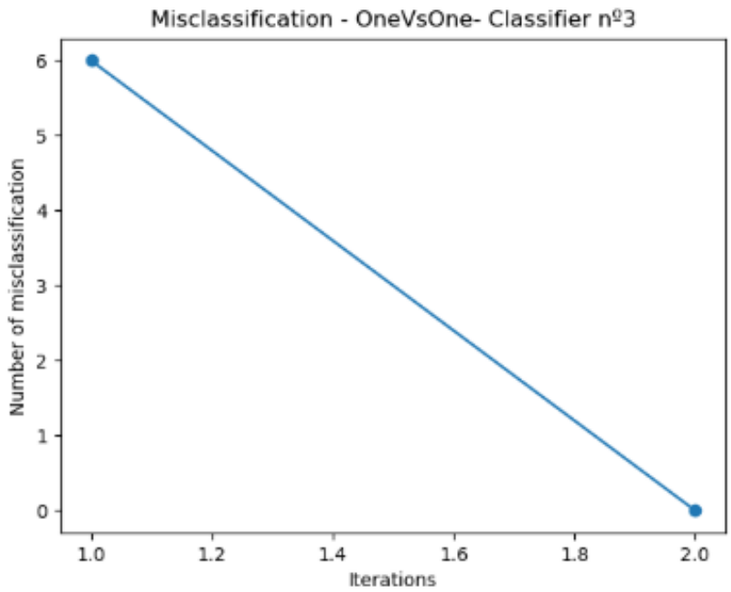

Figura 89: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

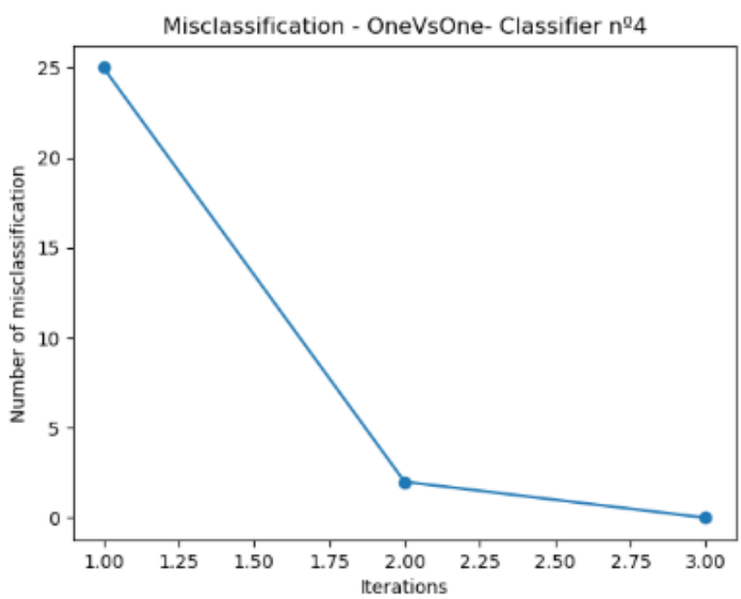

Figura 90: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

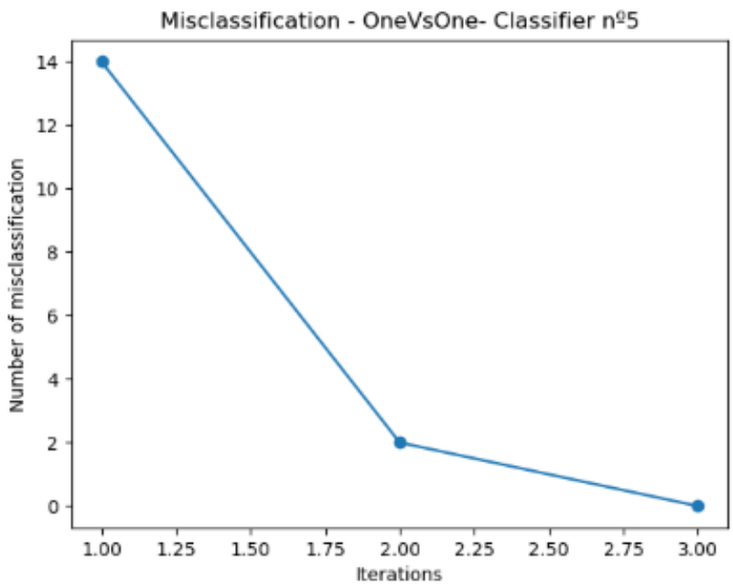

Figura 91: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

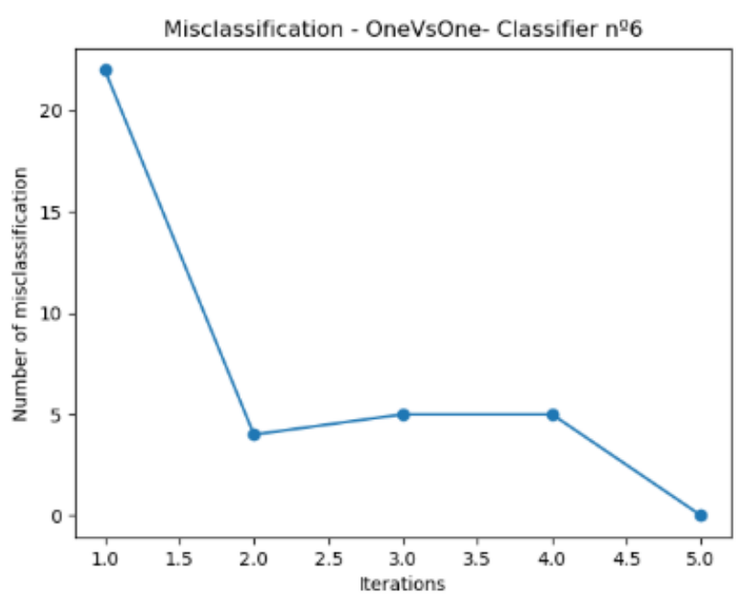

Figura 92: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

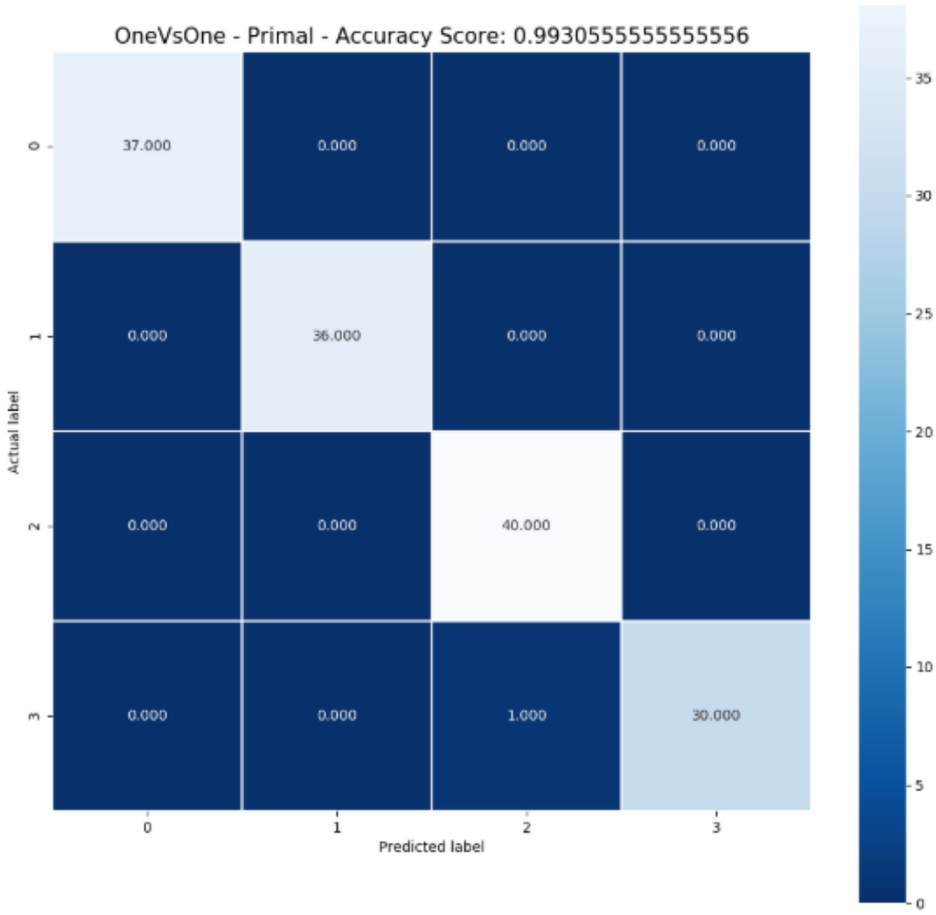

Figura 93: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

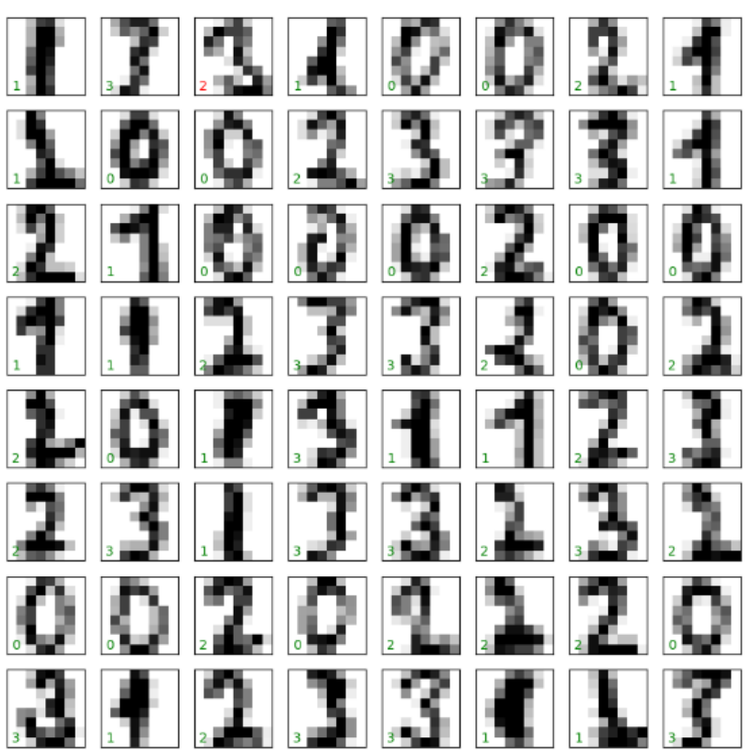

Figura 94: *OneVsOne* — *Predictions* utilizando o *Dataset Digits*

2.3 *Perceptron* Primal com *ECOC*

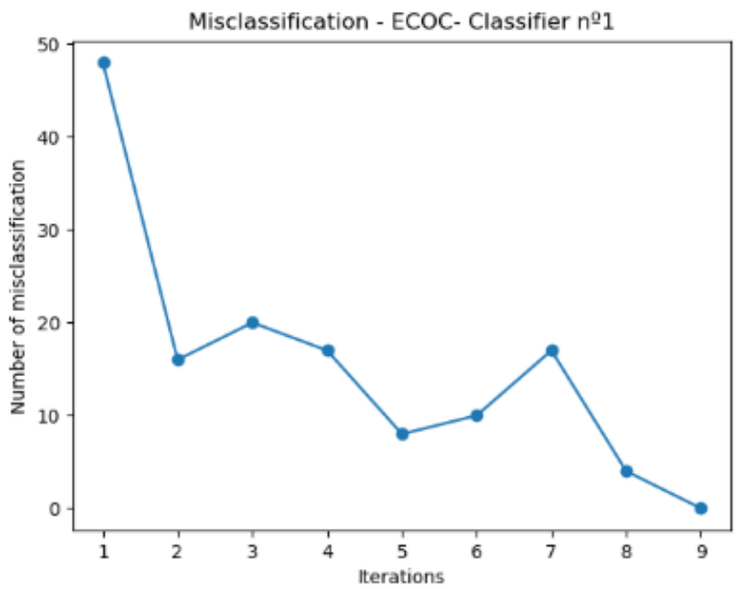

Figura 95: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

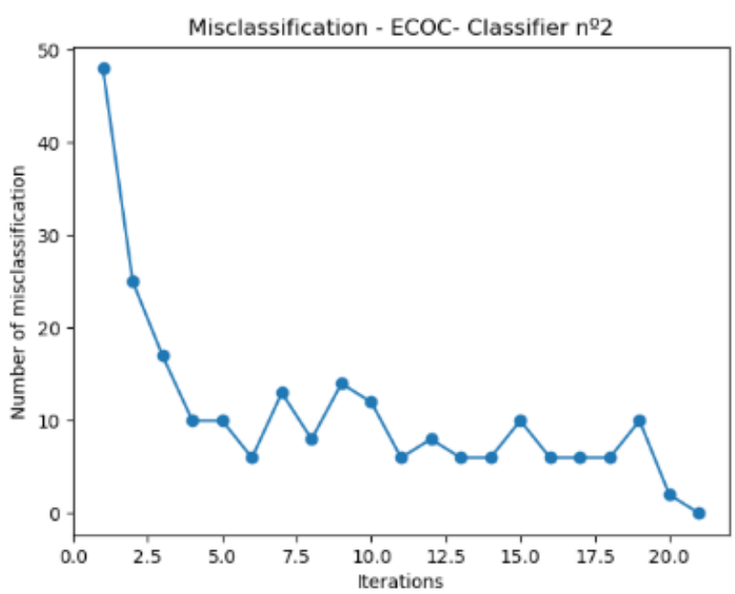

Figura 96: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

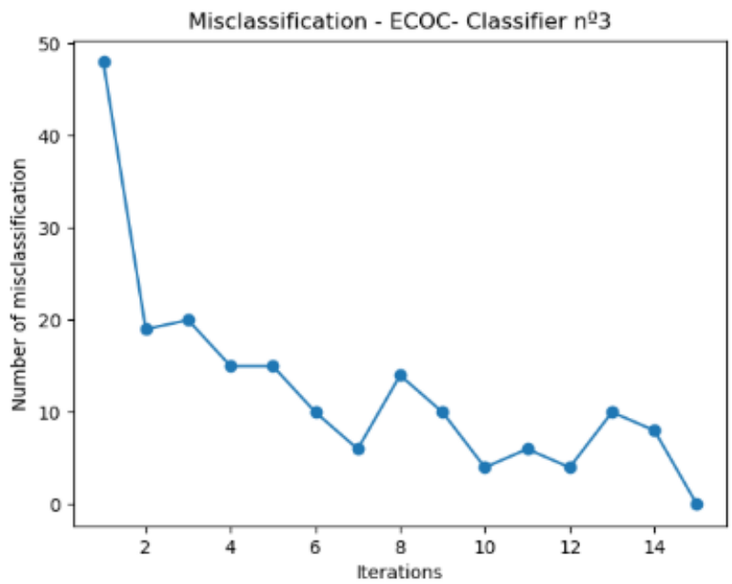

Figura 97: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

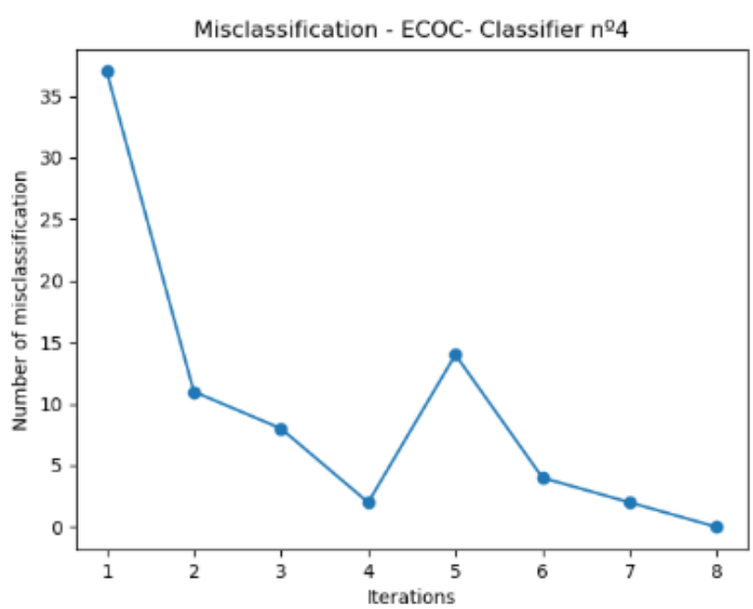

Figura 98: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

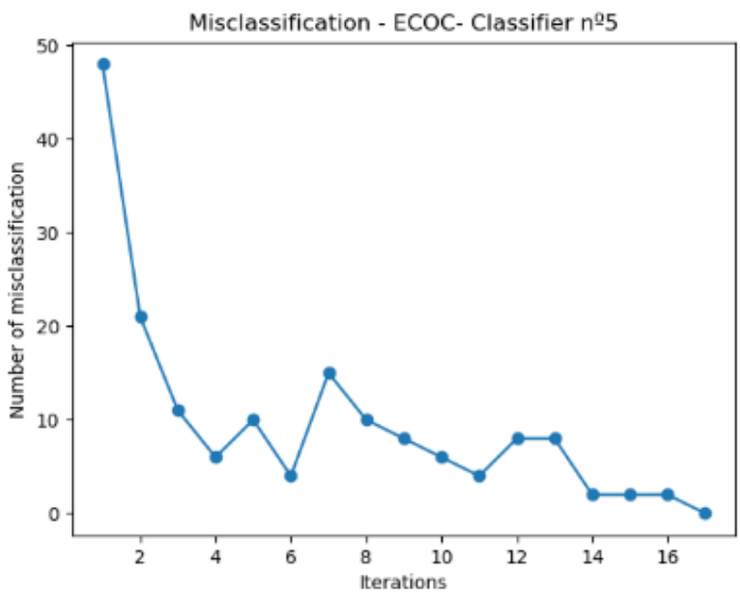

Figura 99: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

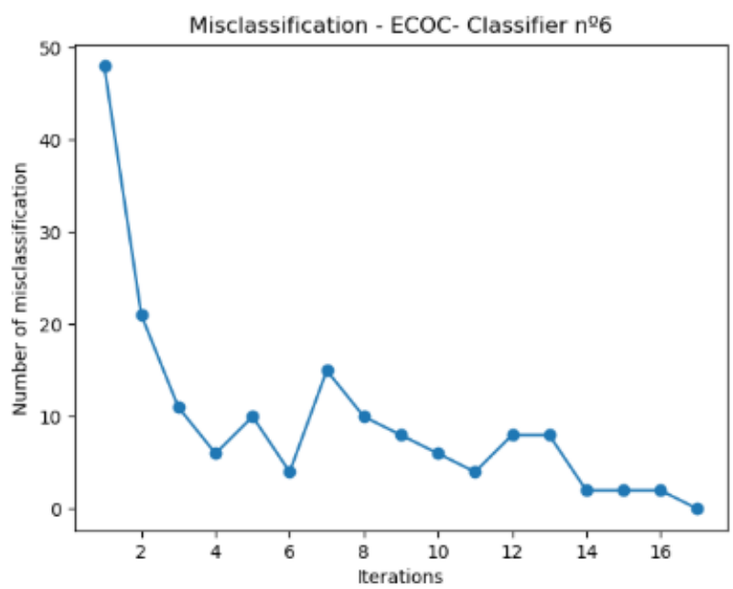

Figura 100: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

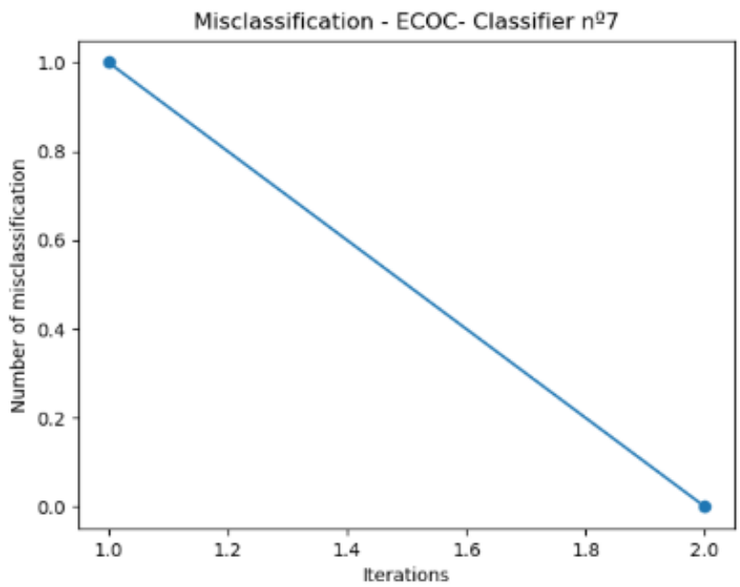

Figura 101: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

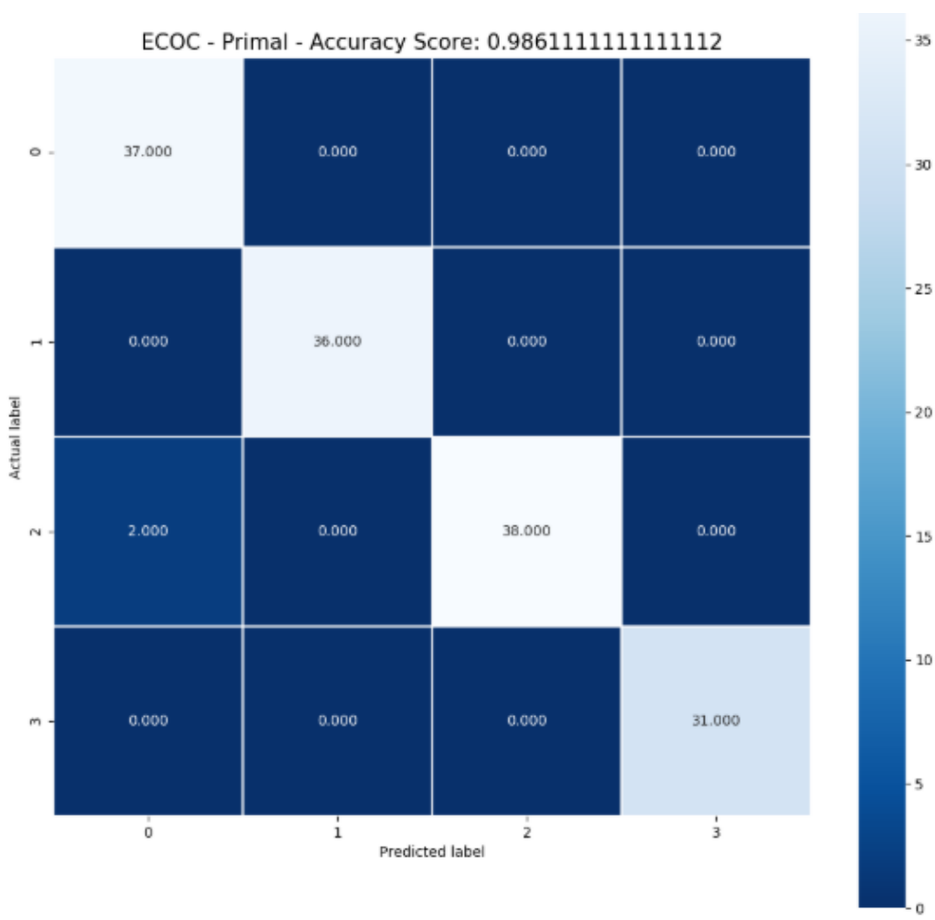

Figura 102: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

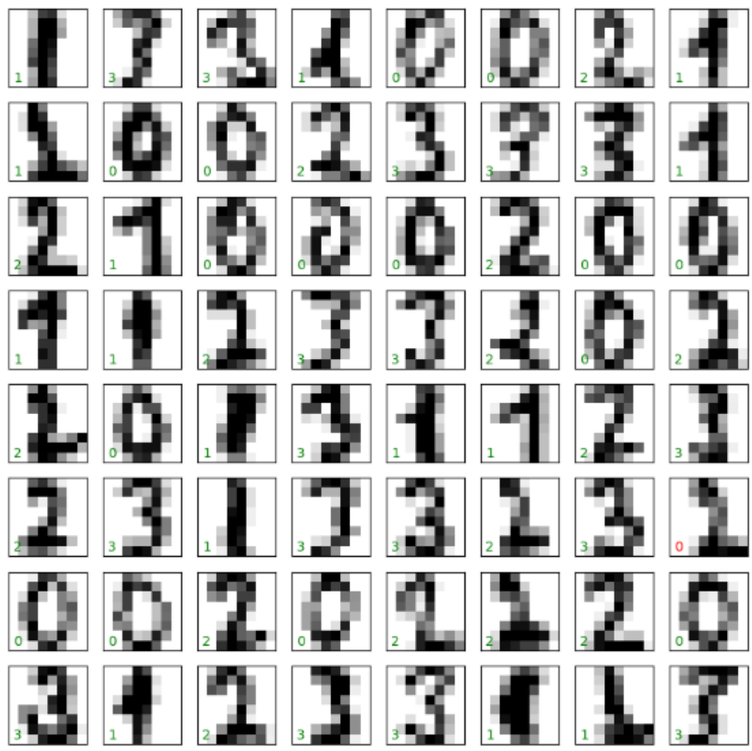

Figura 103: *ECOC* — *Predictions* utilizando o *Dataset Digits*

2.4 *Perceptron* Dual com *OVA*

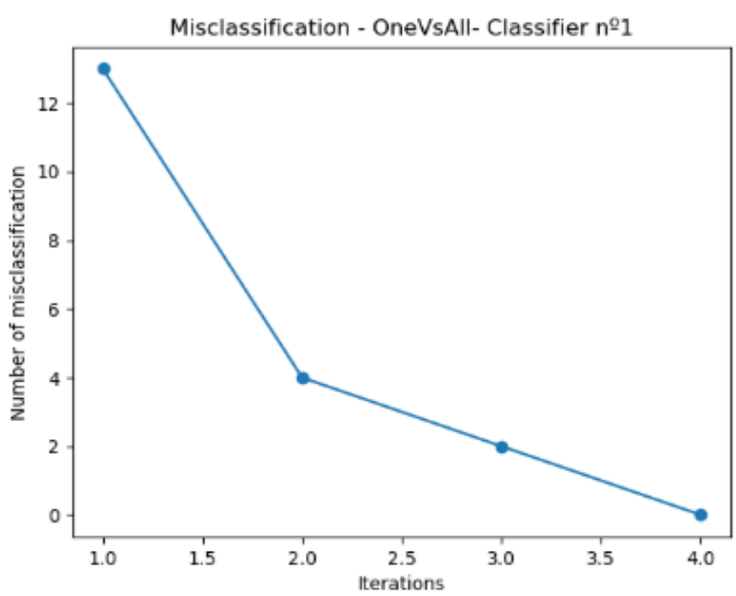

Figura 104: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

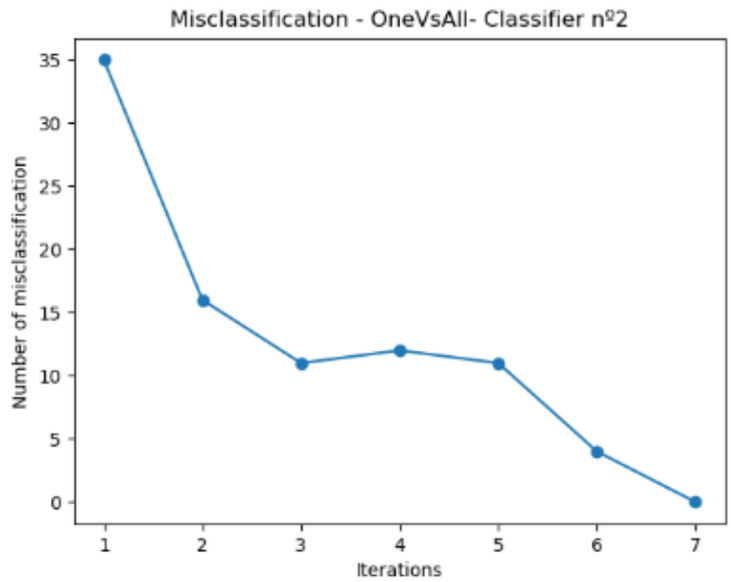

Figura 105: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

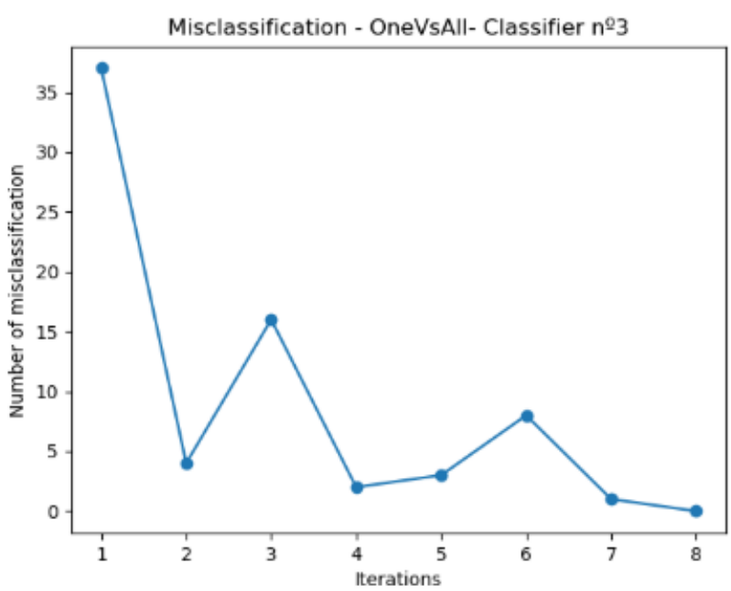

Figura 106: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

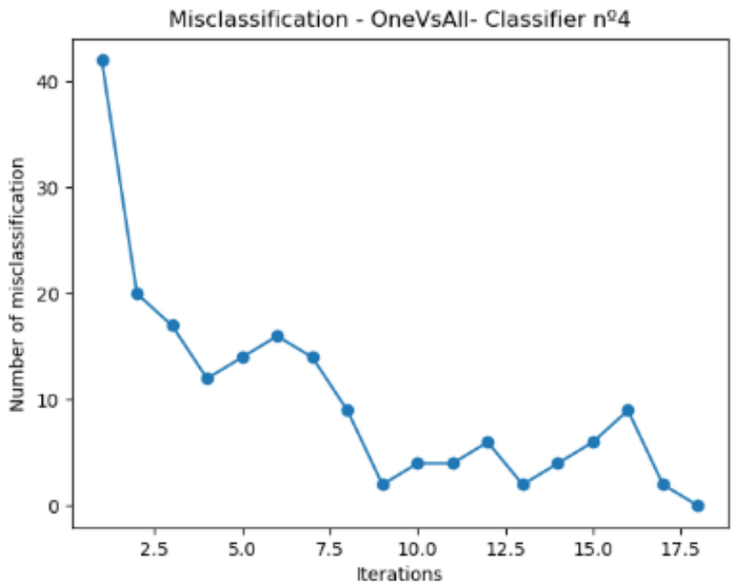

Figura 107: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

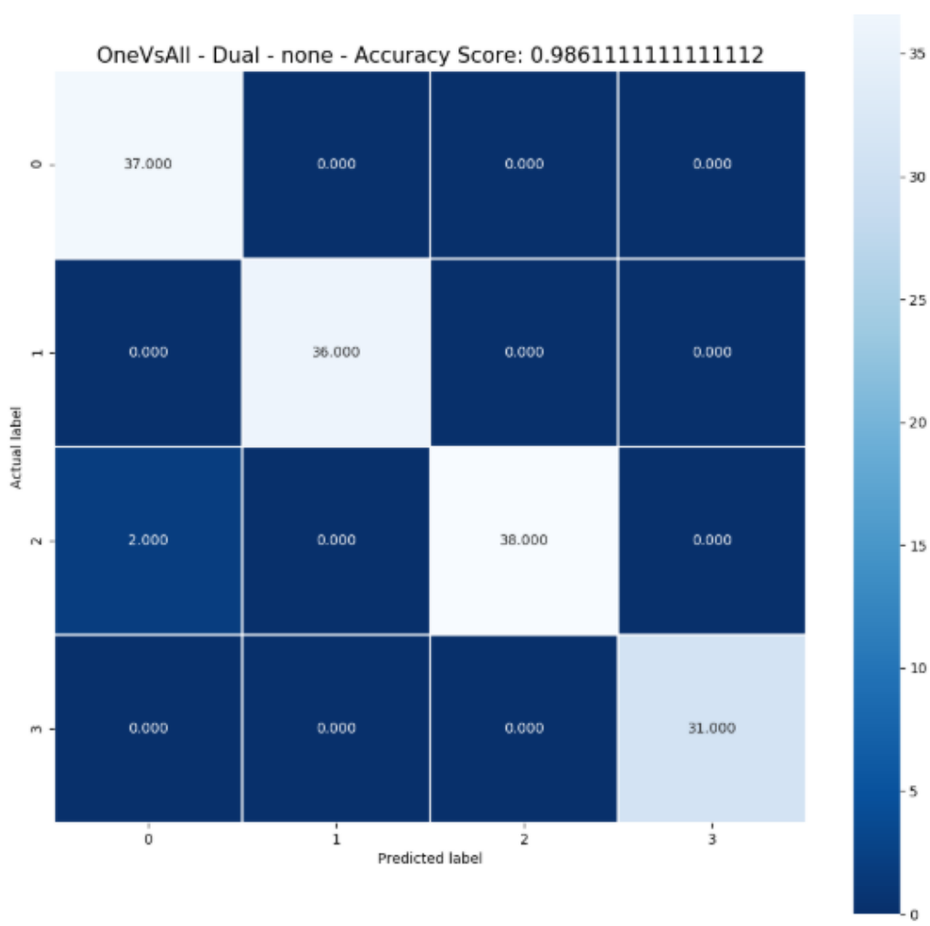

Figura 108: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

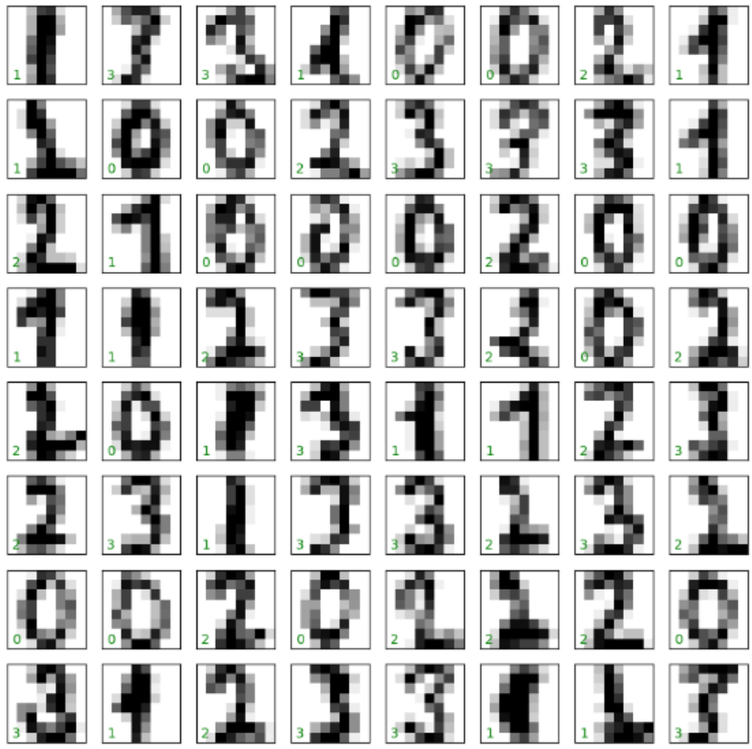

Figura 109: *OneVsAll* — *Predictions* utilizando o *Dataset Digits*

2.5 *Perceptron* Dual com *OVO*

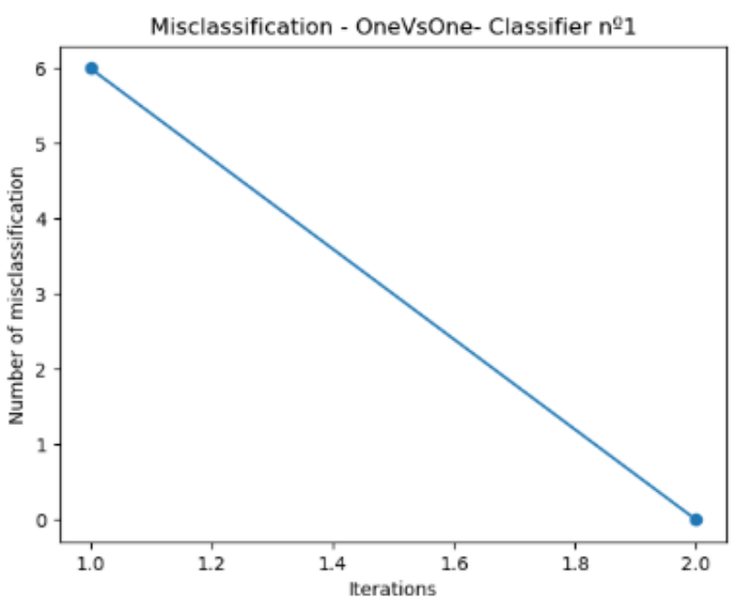

Figura 110: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

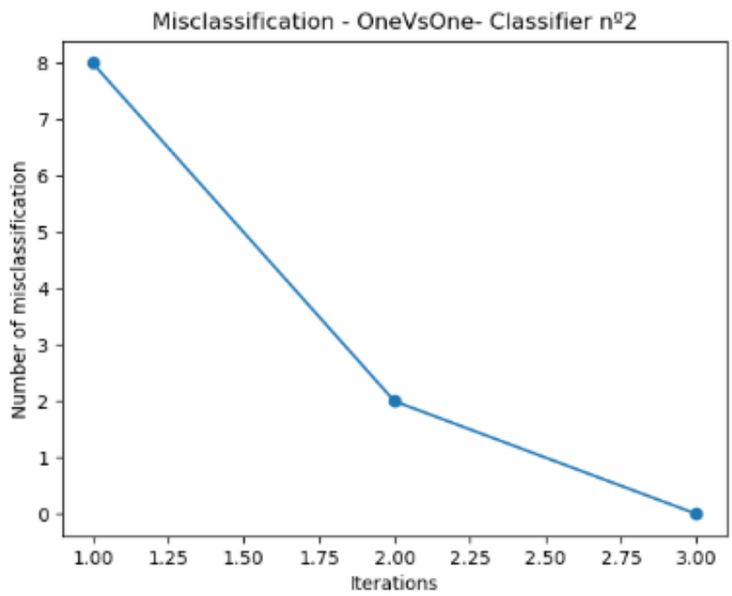

Figura 111: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

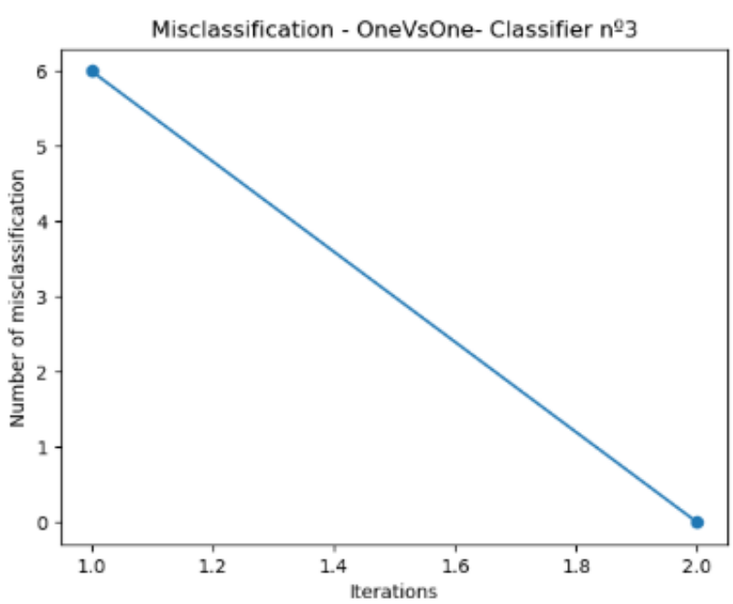

Figura 112: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

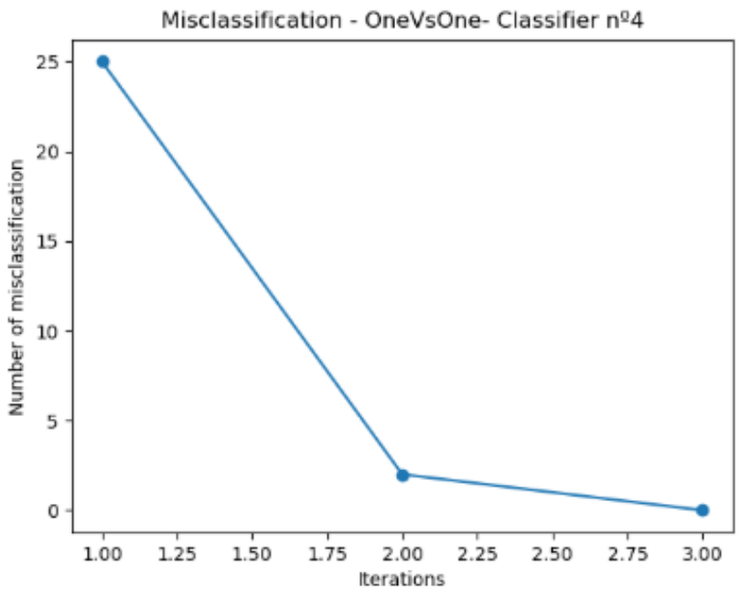

Figura 113: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

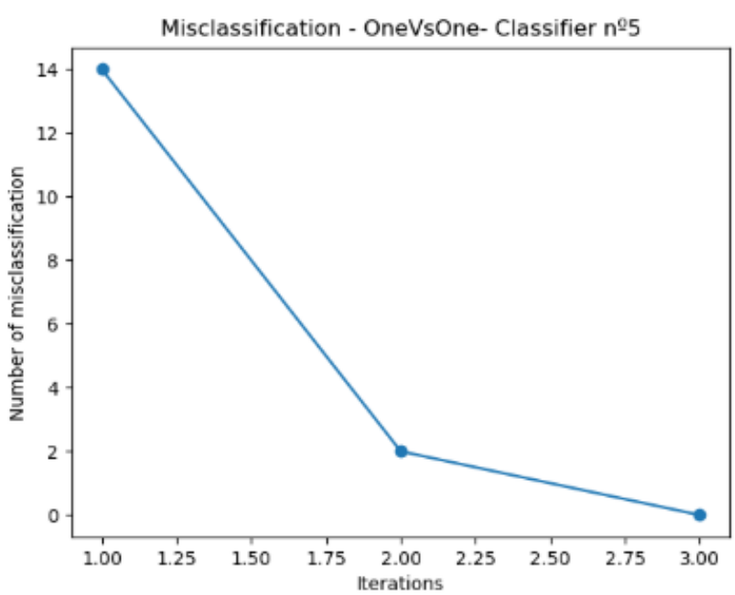

Figura 114: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

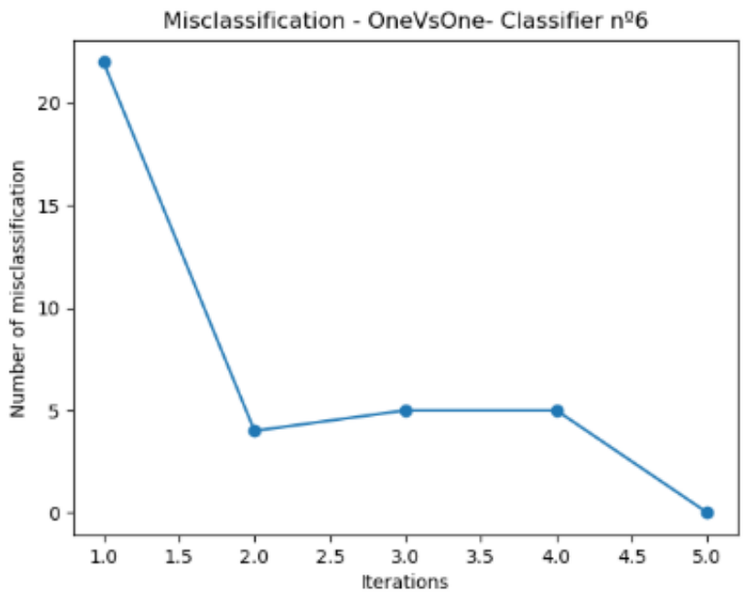

Figura 115: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

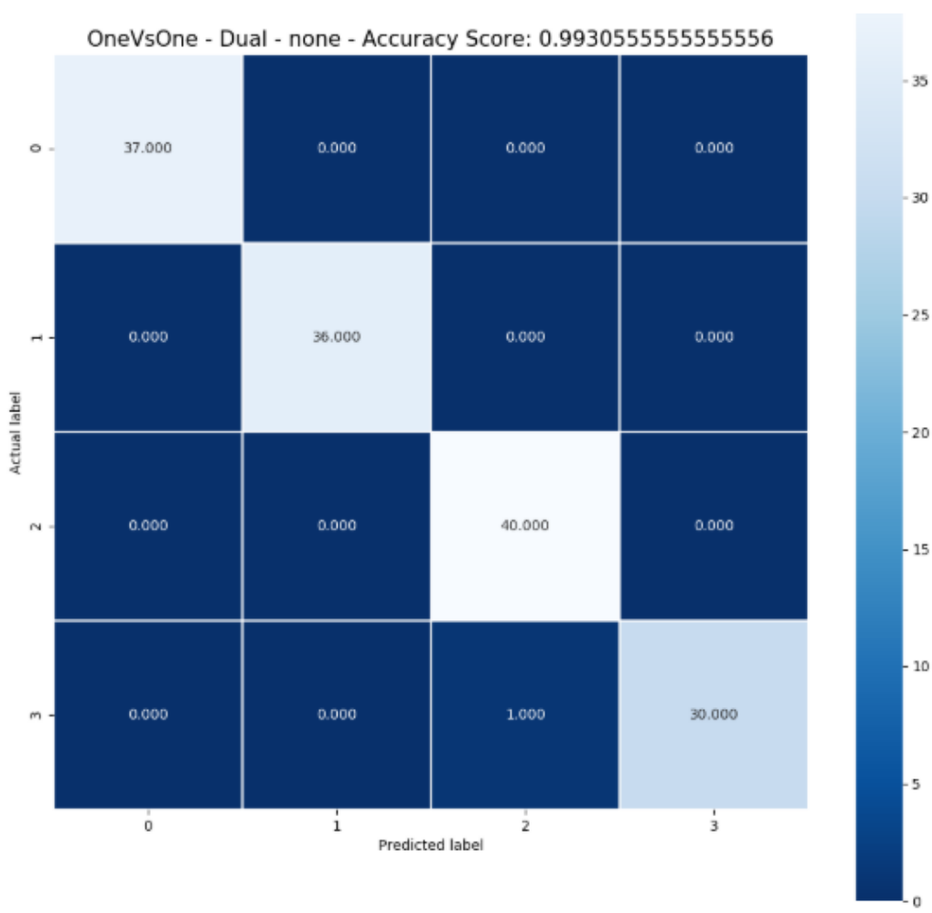

Figura 116: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

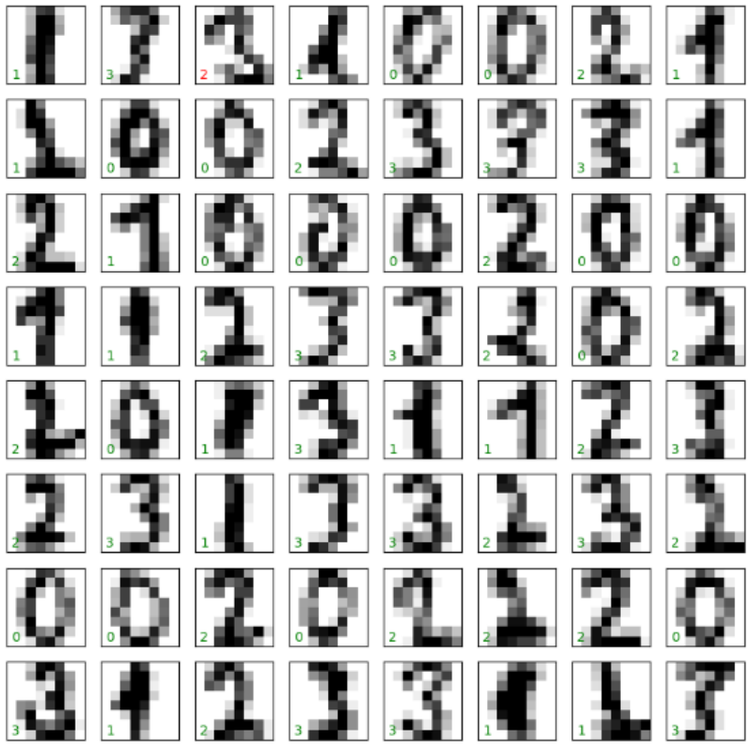

Figura 117: *OneVsOne* — *Predictions* utilizando o *Dataset Digits*

2.6 *Perceptron* Dual com *ECOC*

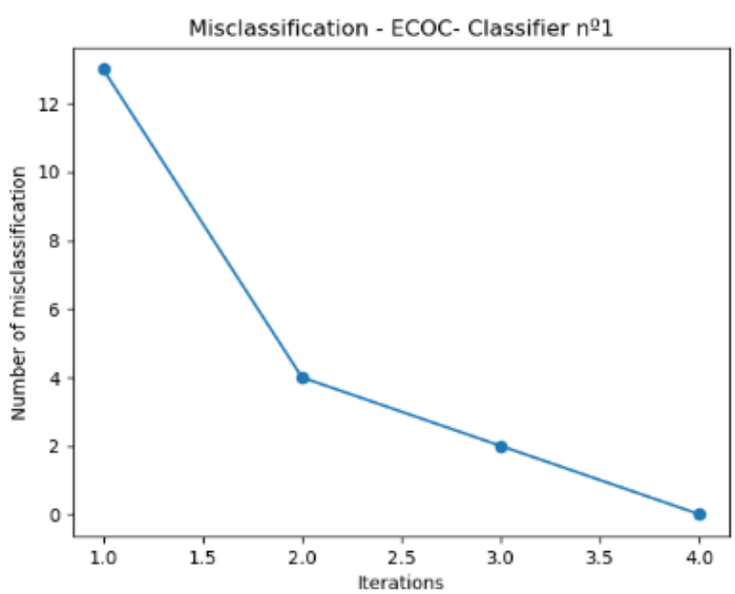

Figura 118: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

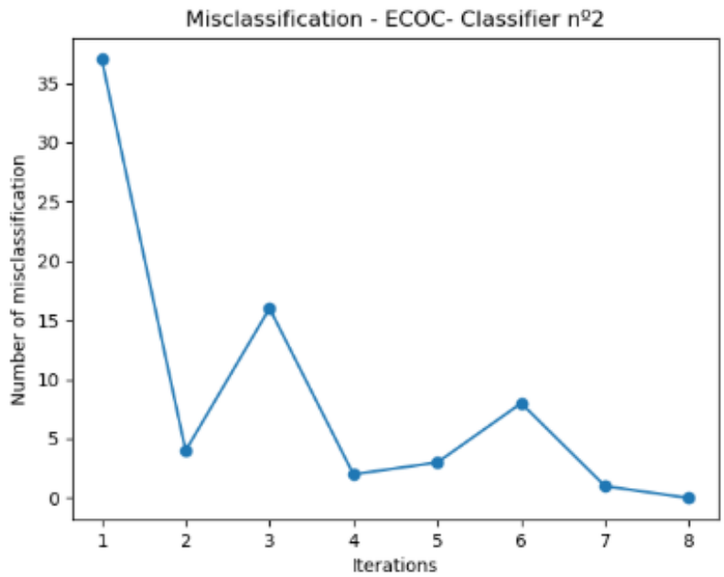

Figura 119: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

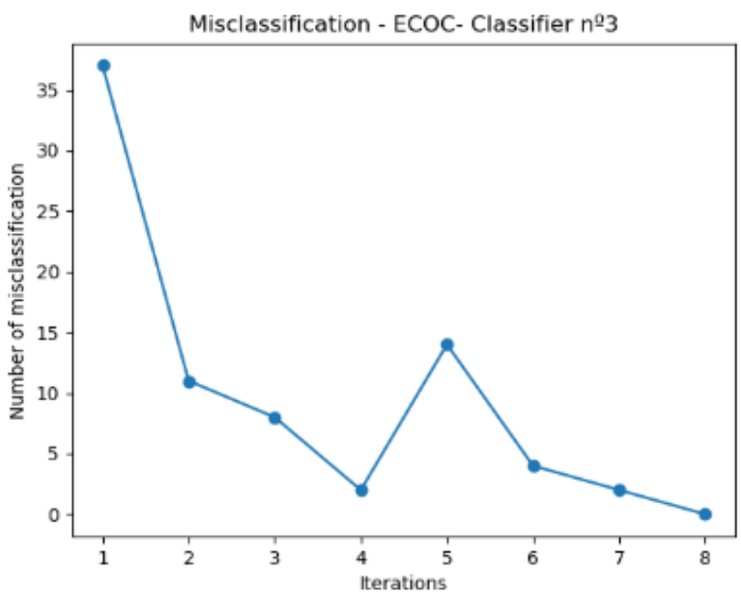

Figura 120: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

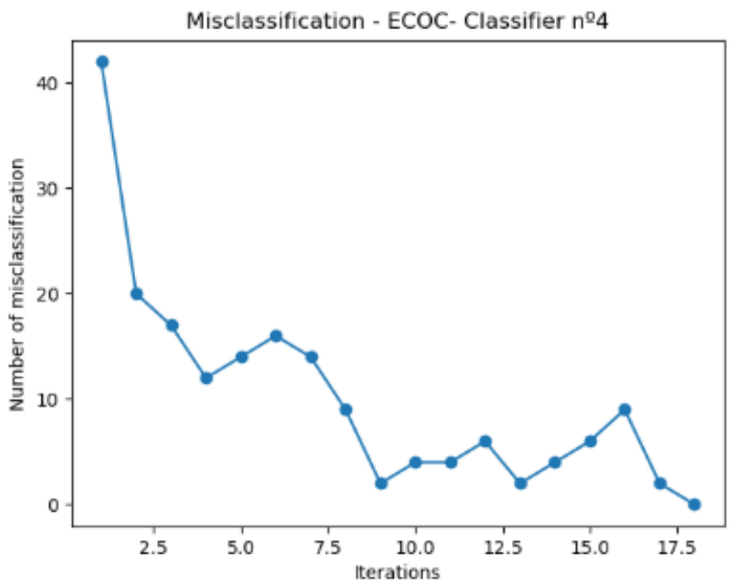

Figura 121: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

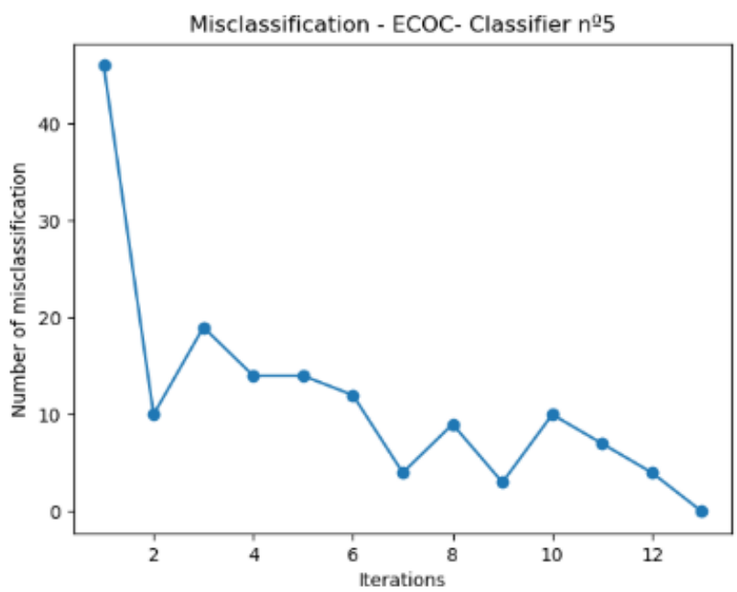

Figura 122: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

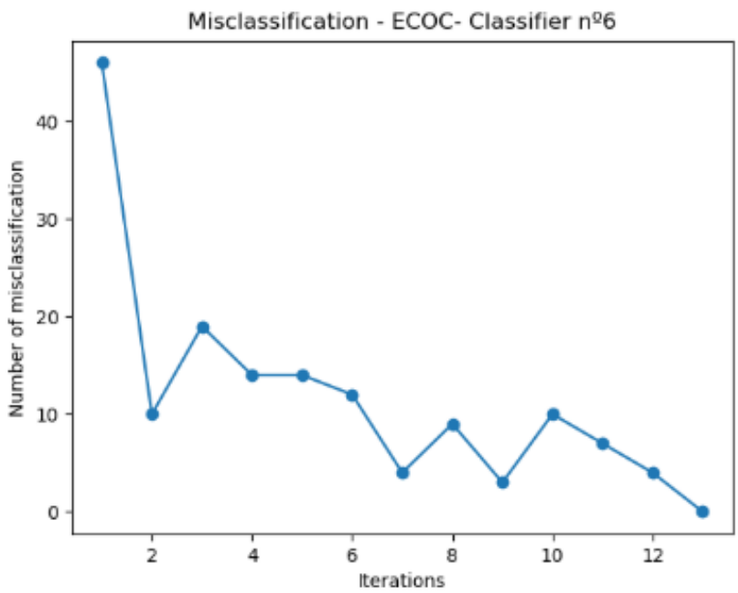

Figura 123: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

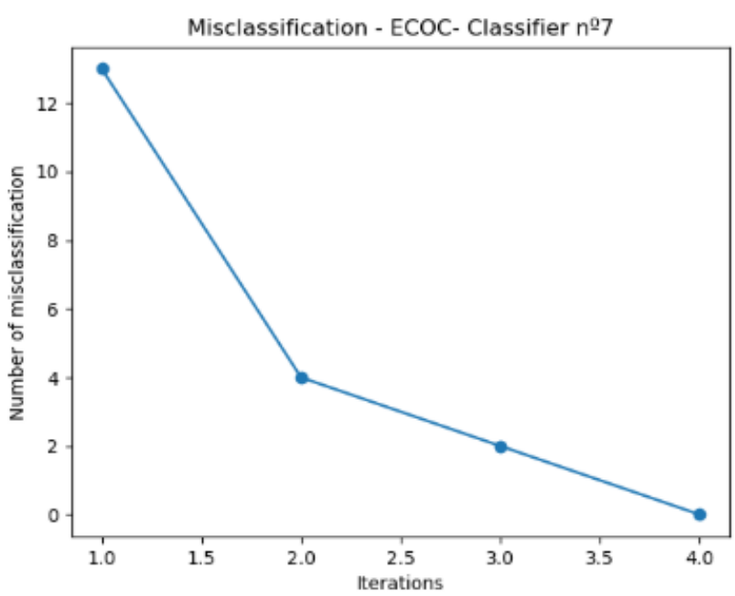

Figura 124: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

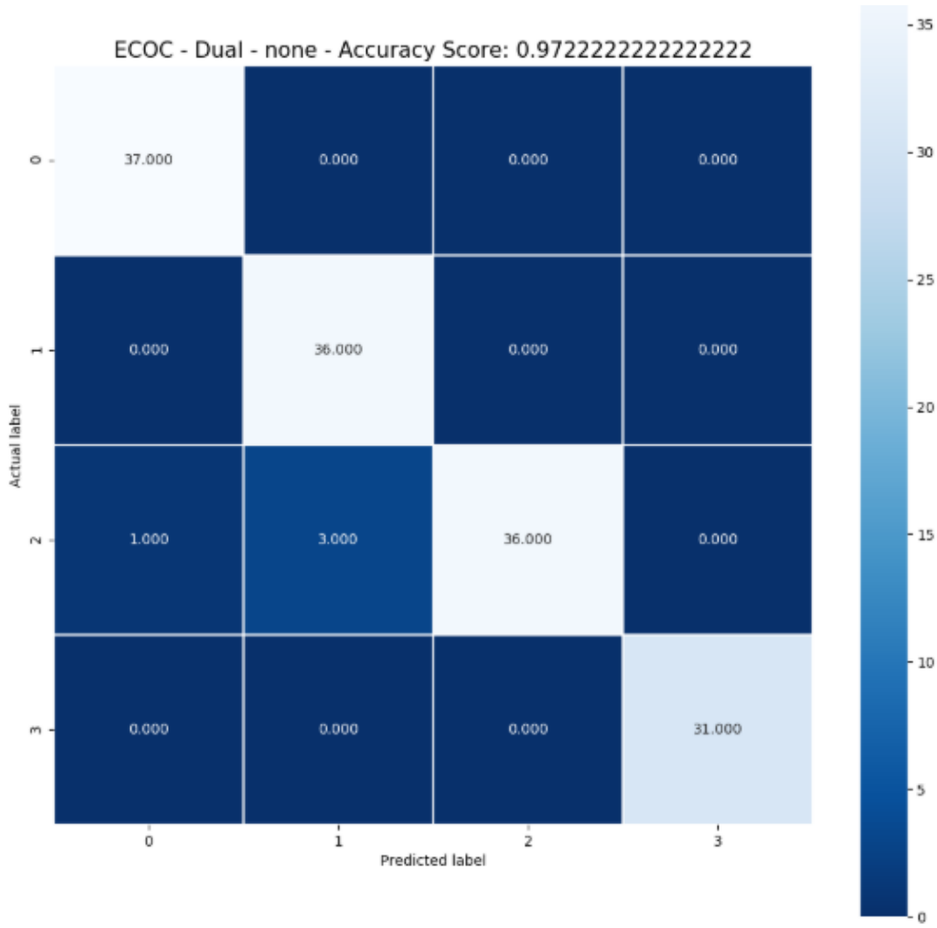

Figura 125: *ECOC — Accuracy* utilizando o *Dataset Digits*

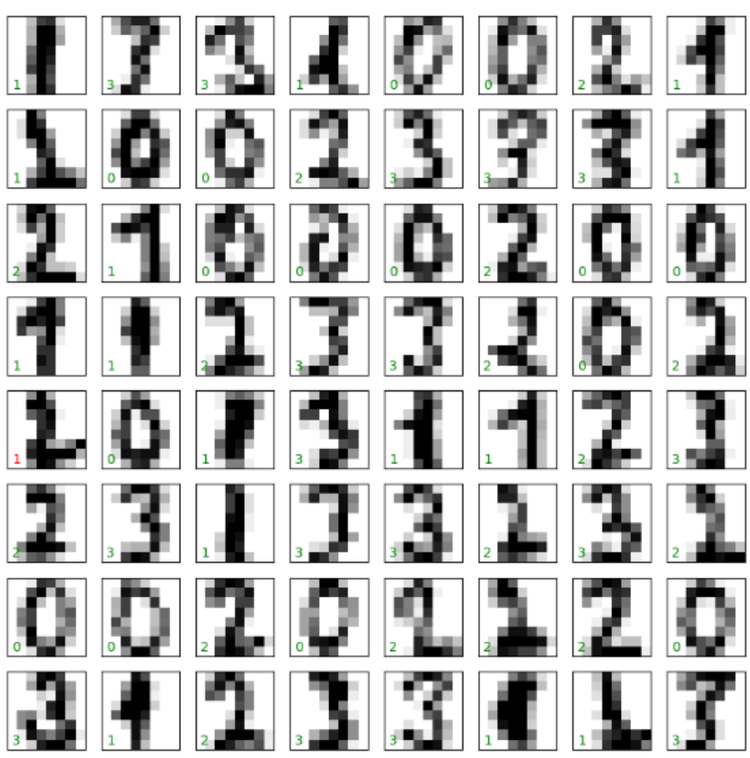

Figura 126: *ECOC — Predictions* utilizando o *Dataset Digits*

2.7 *Perceptron* Dual com *Kernel RBF* com *OVA*

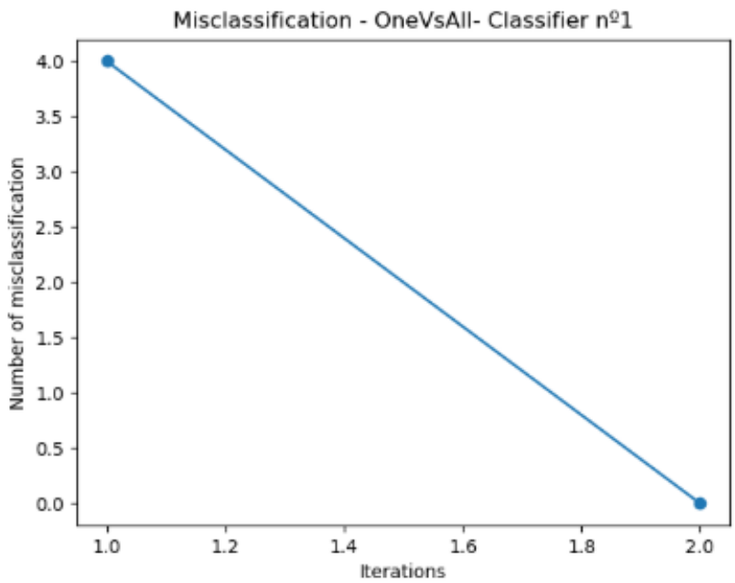

Figura 127: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

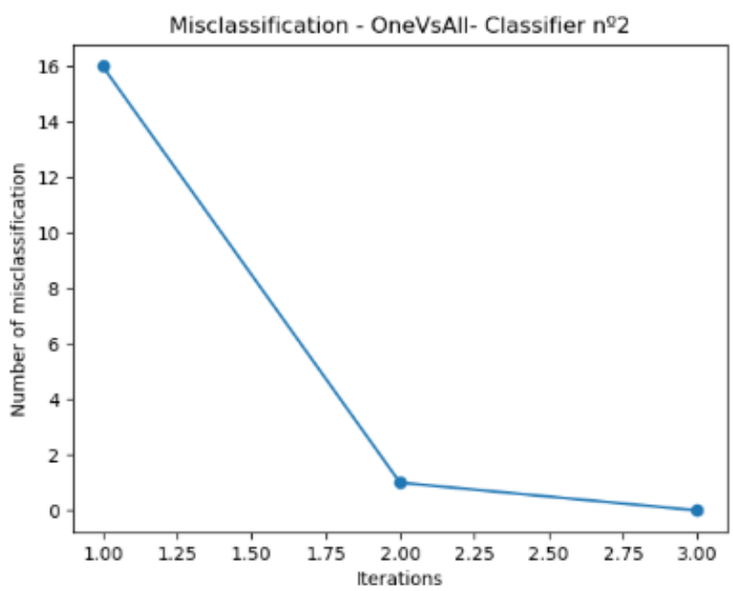

Figura 128: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

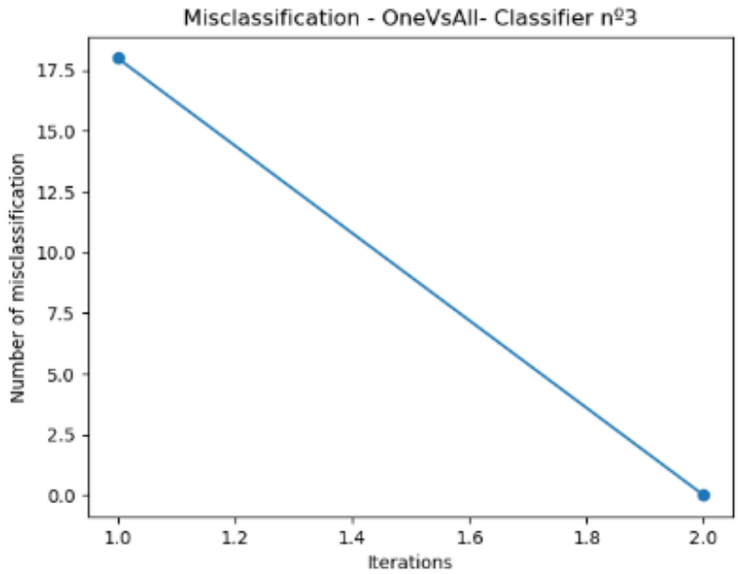

Figura 129: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

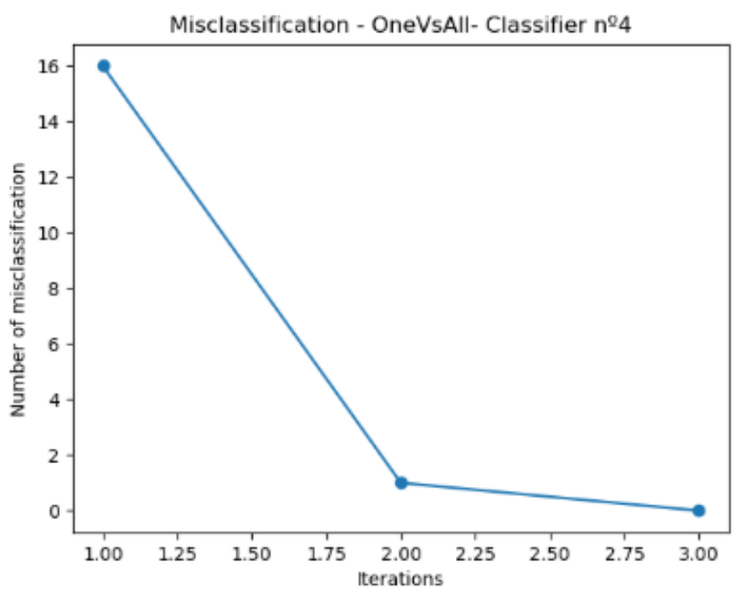

Figura 130: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

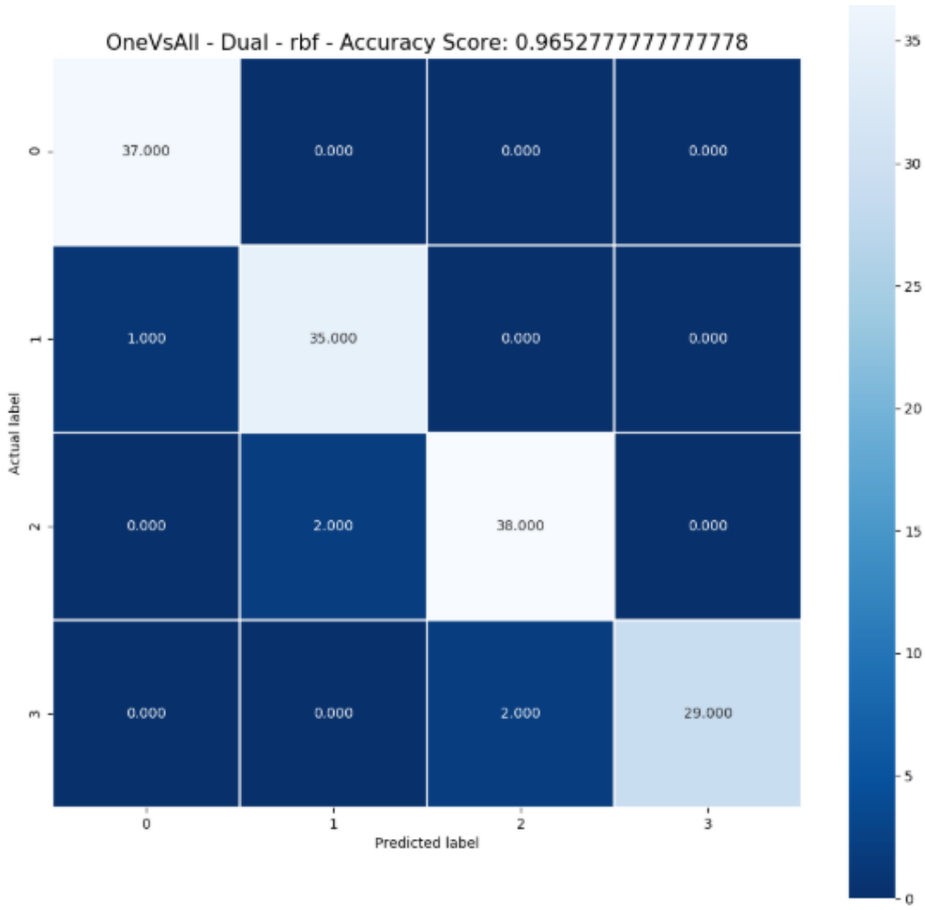

Figura 131: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

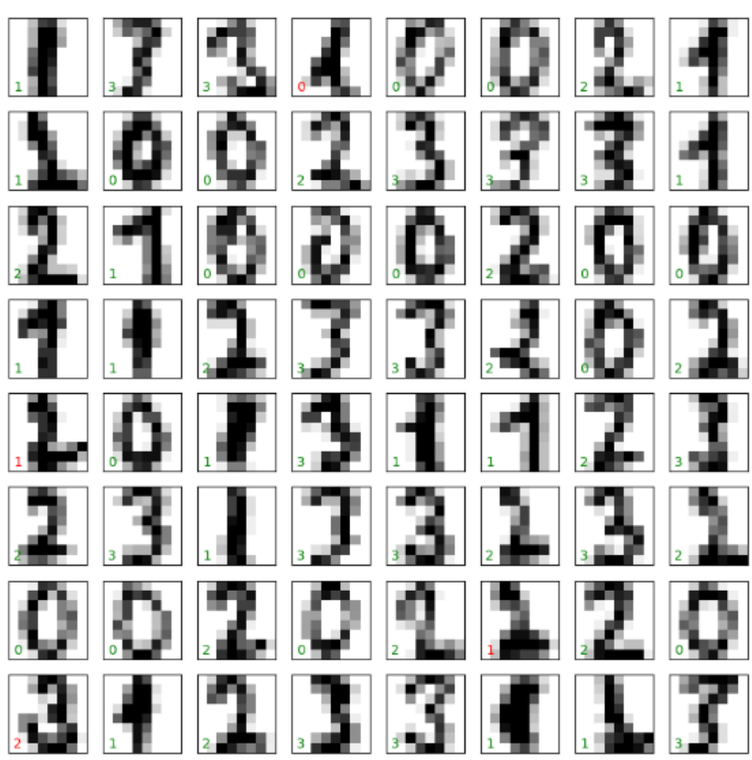

Figura 132: *OneVsAll* — *Predictions* utilizando o *Dataset Digits*

2.8 *Perceptron* Dual com *Kernel RBF* com *OVO*

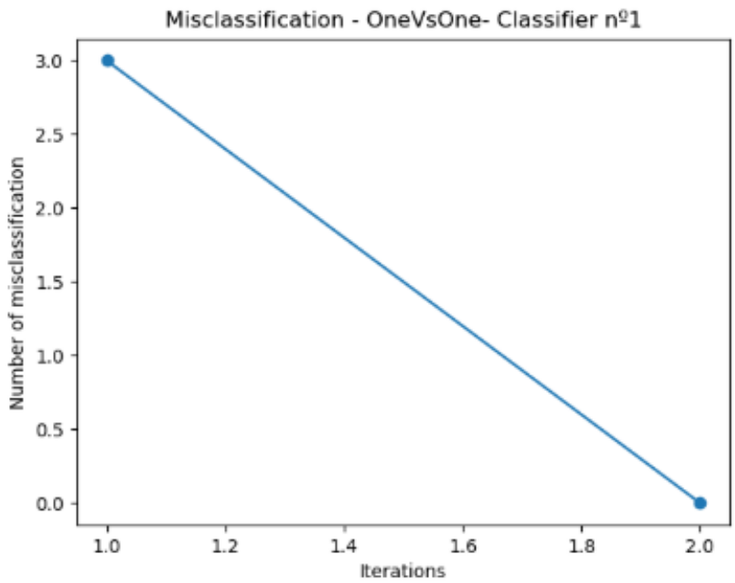

Figura 133: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

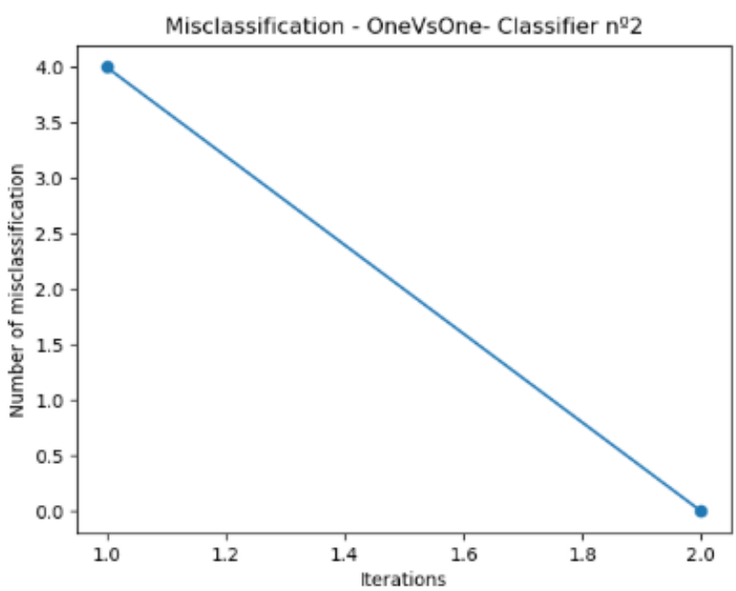

Figura 134: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

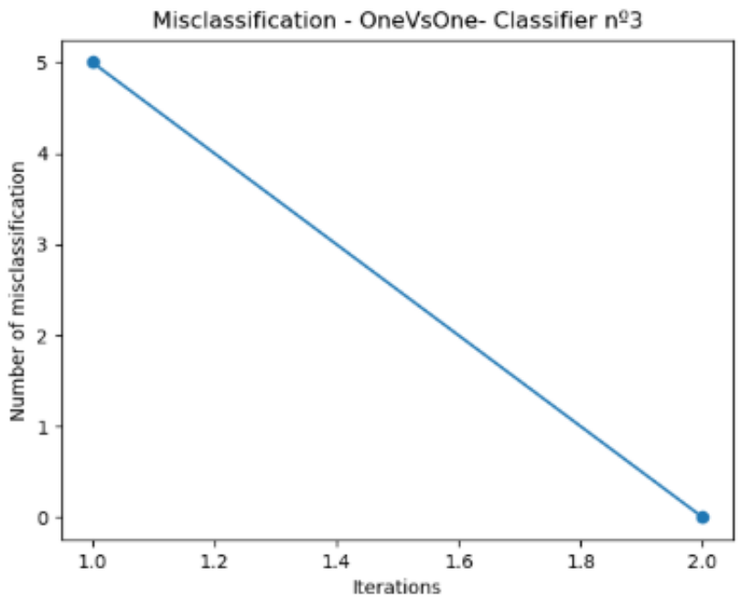

Figura 135: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

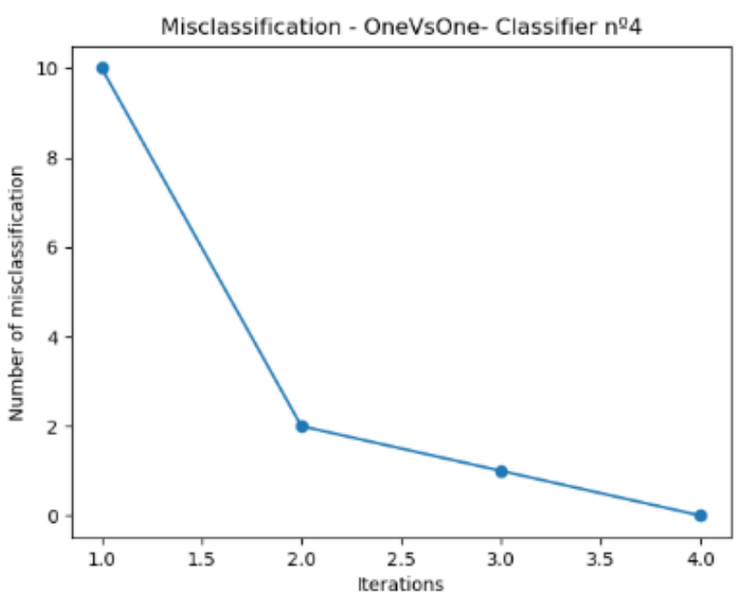

Figura 136: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

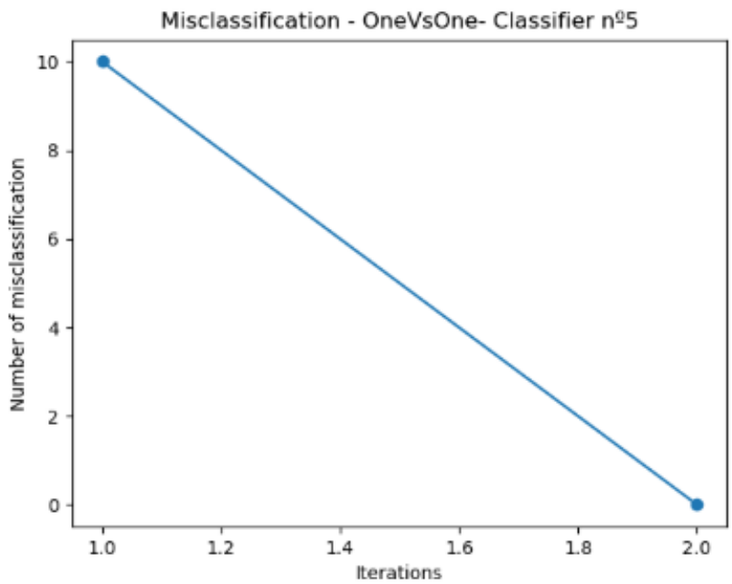

Figura 137: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

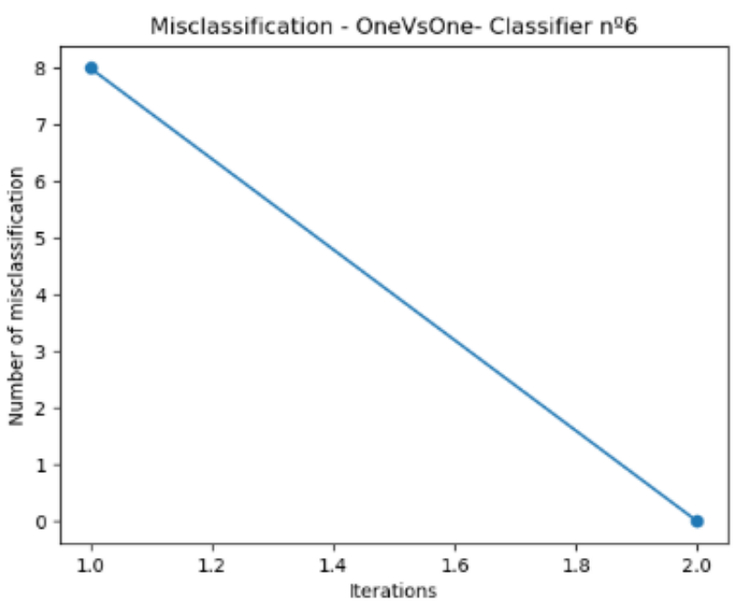

Figura 138: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

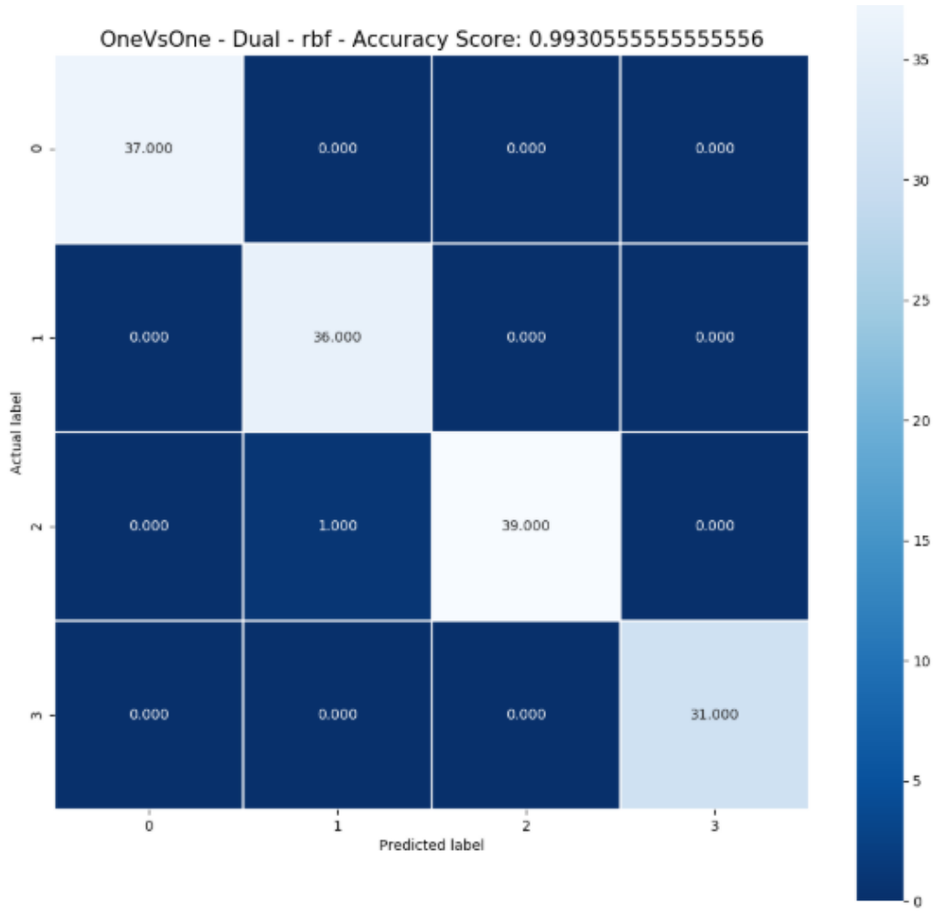

Figura 139: *OneVsOne — Accuracy* utilizando o *Dataset Digits*

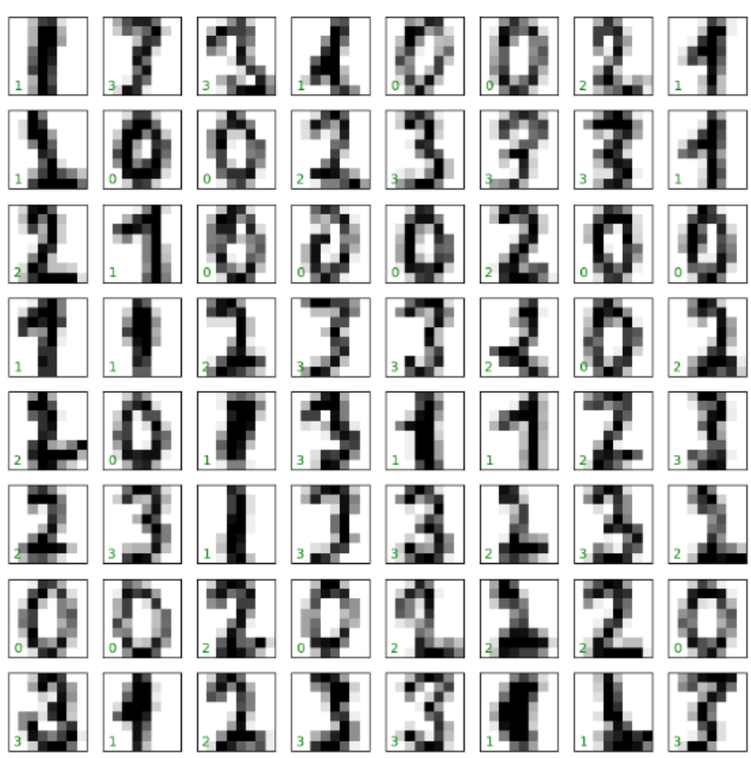

Figura 140: *OneVsOne — Predictions* utilizando o *Dataset Digits*

2.9 *Perceptron* Dual com *Kernel RBF* com *ECOC*

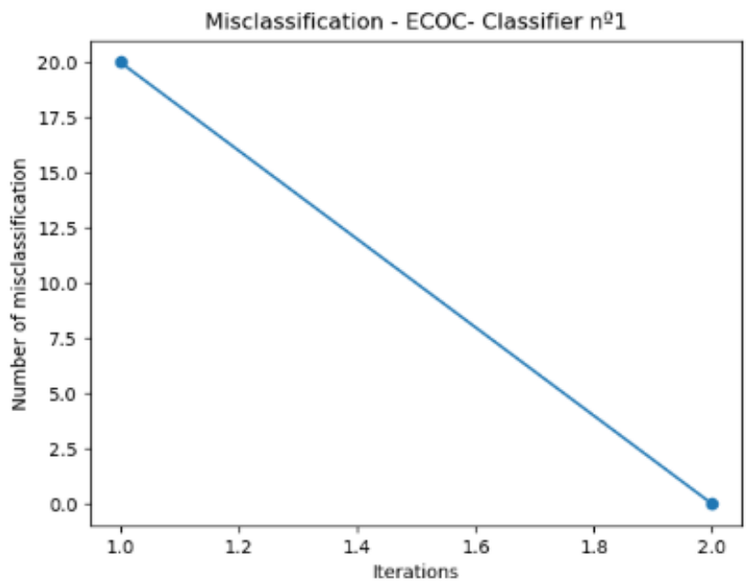

Figura 141: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

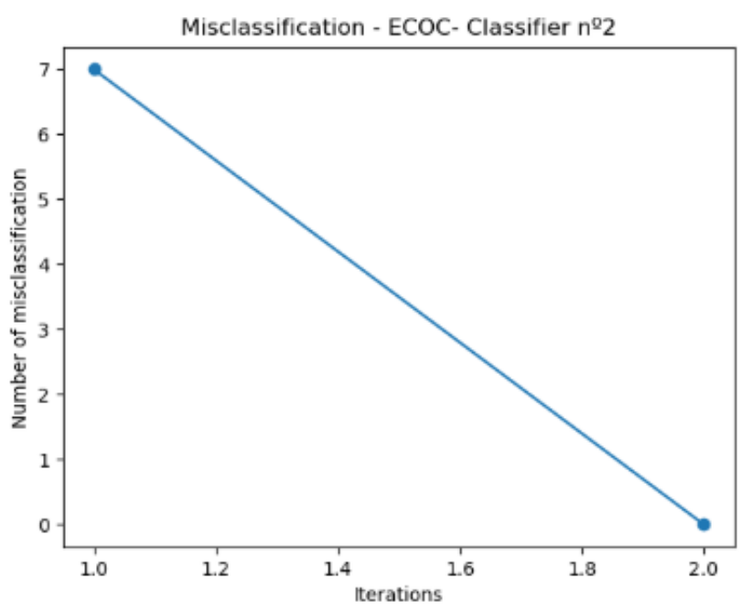

Figura 142: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

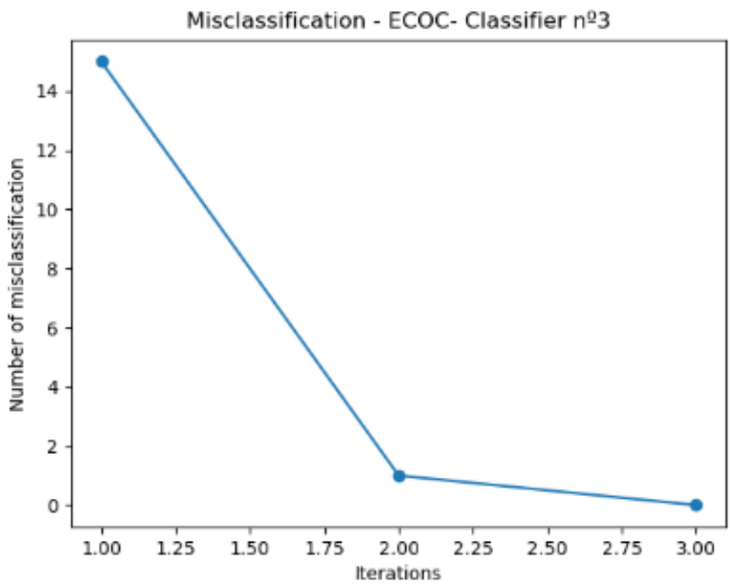

Figura 143: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

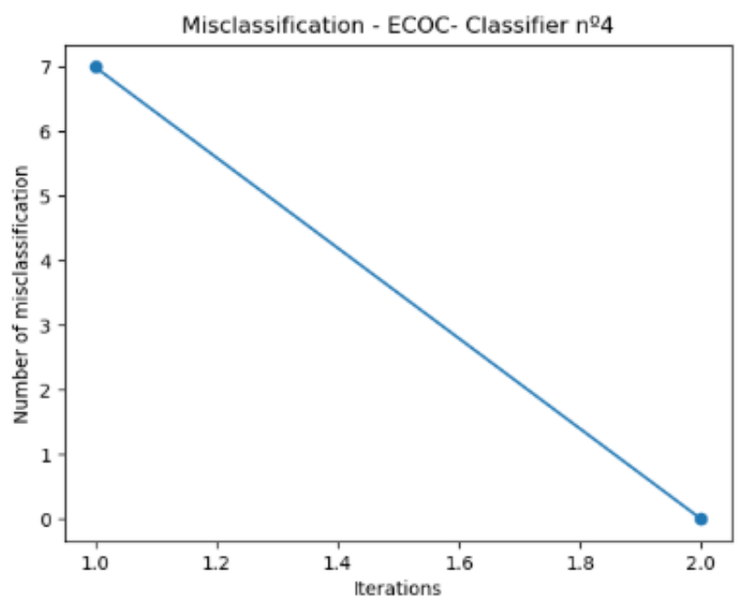

Figura 144: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

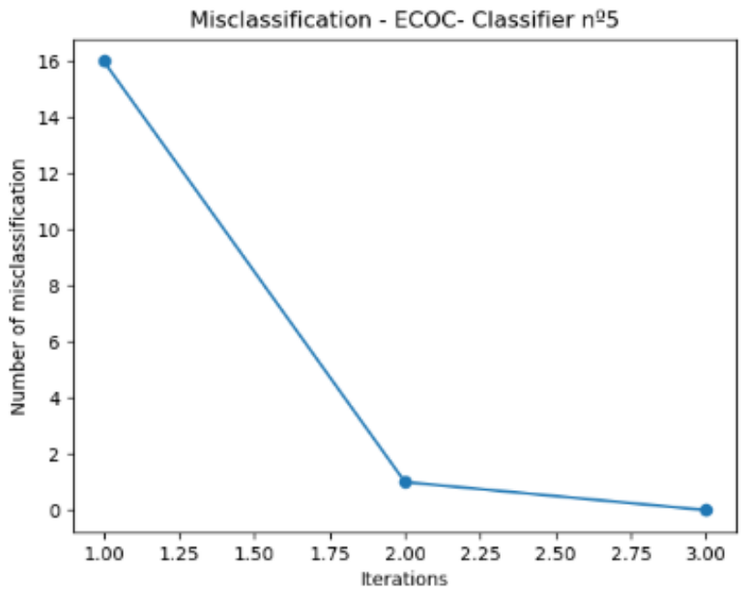

Figura 145: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

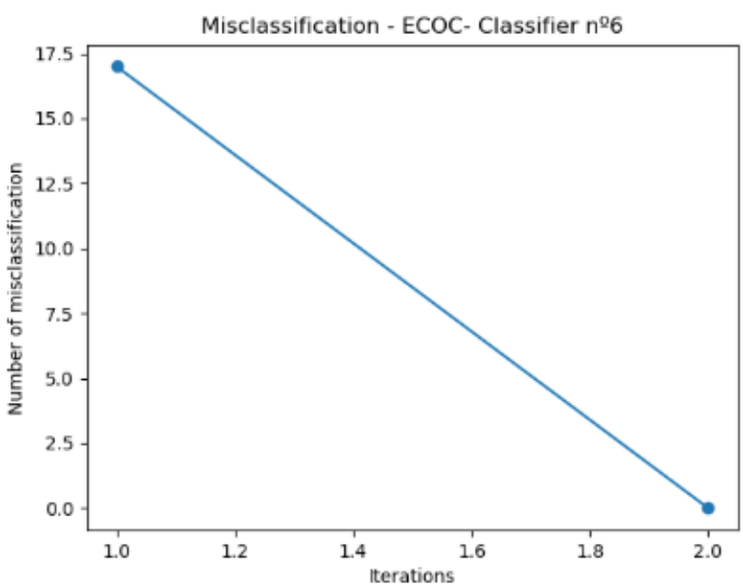

Figura 146: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

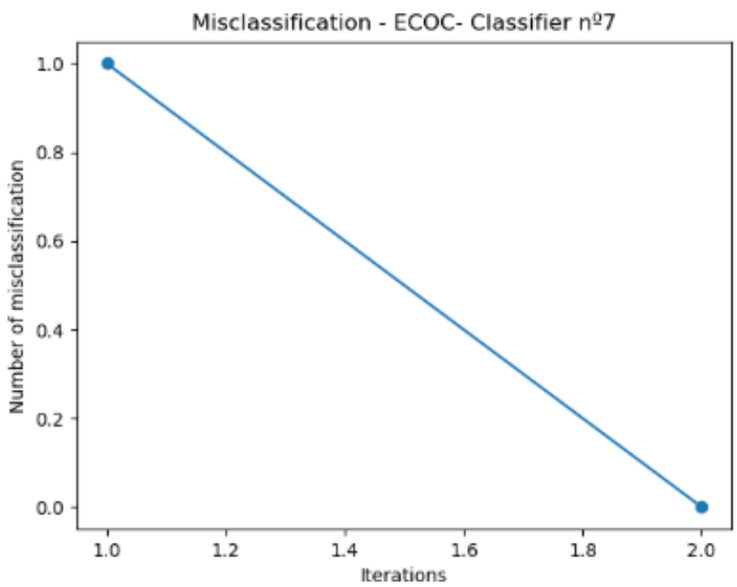

Figura 147: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

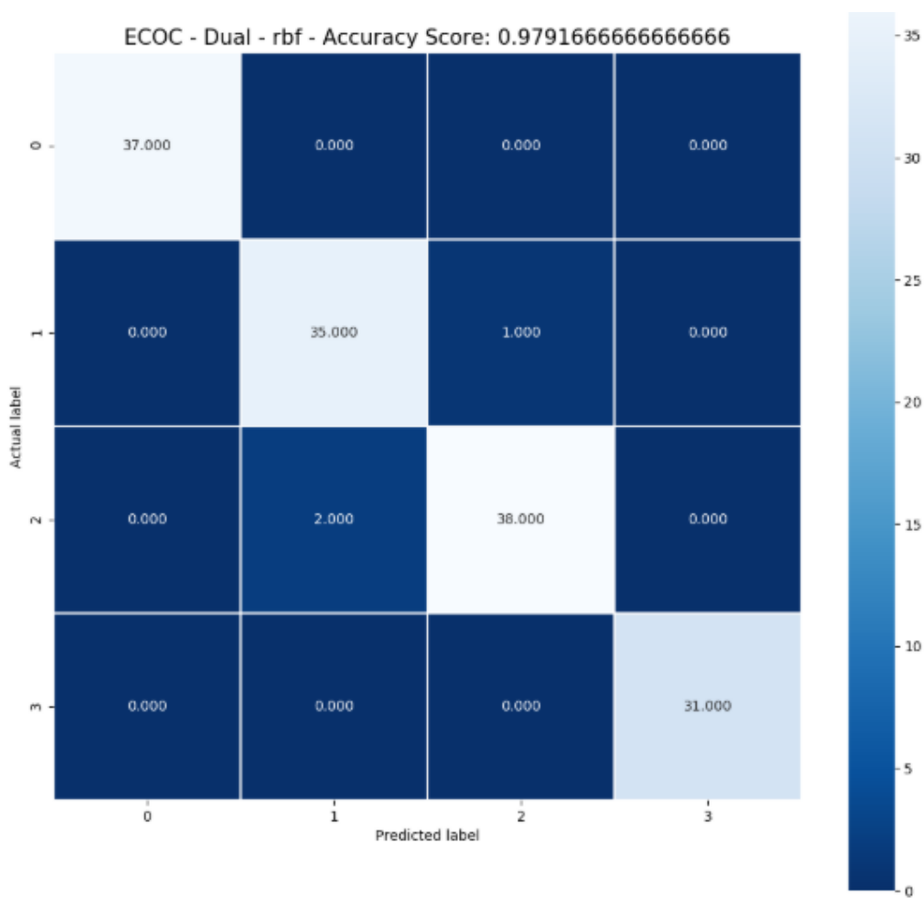

Figura 148: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

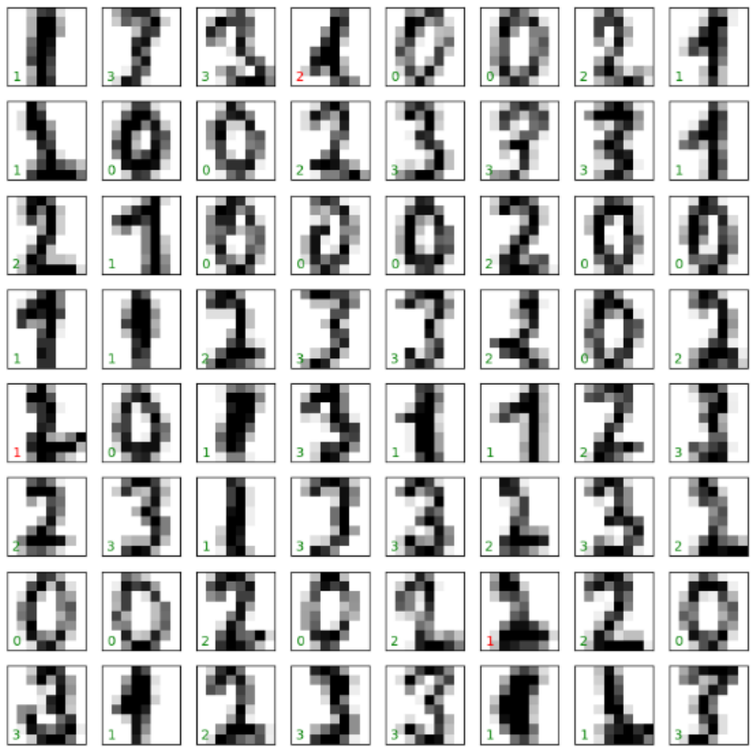

Figura 149: *ECOC* — *Predictions* utilizando o *Dataset Digits*

2.10 *Perceptron* Dual com *Kernel* Polinomial com *OVA*

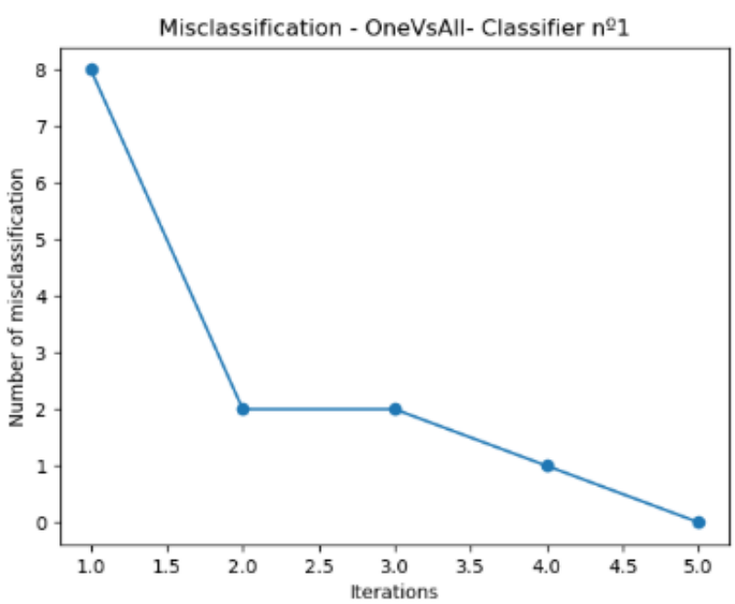

Figura 150: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

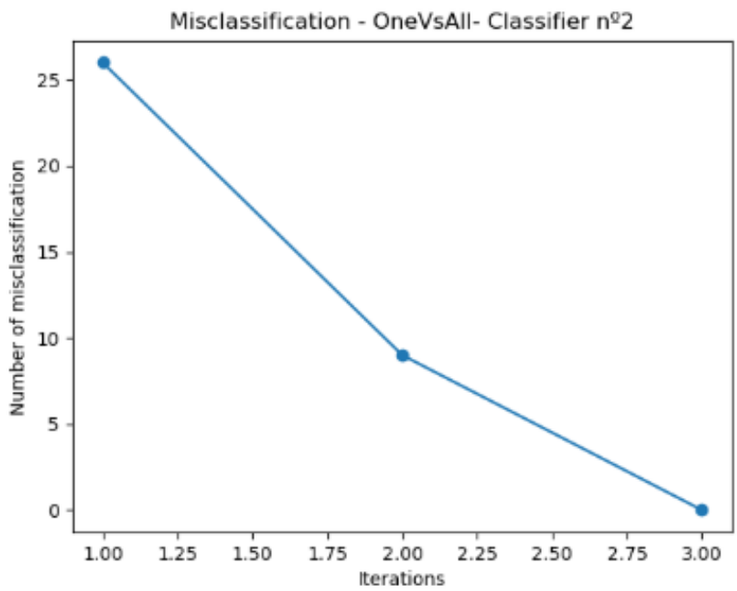

Figura 151: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

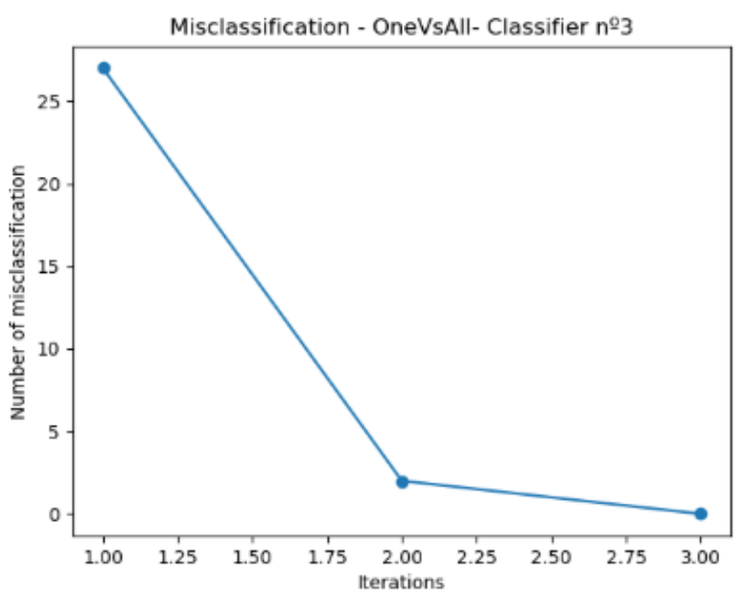

Figura 152: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

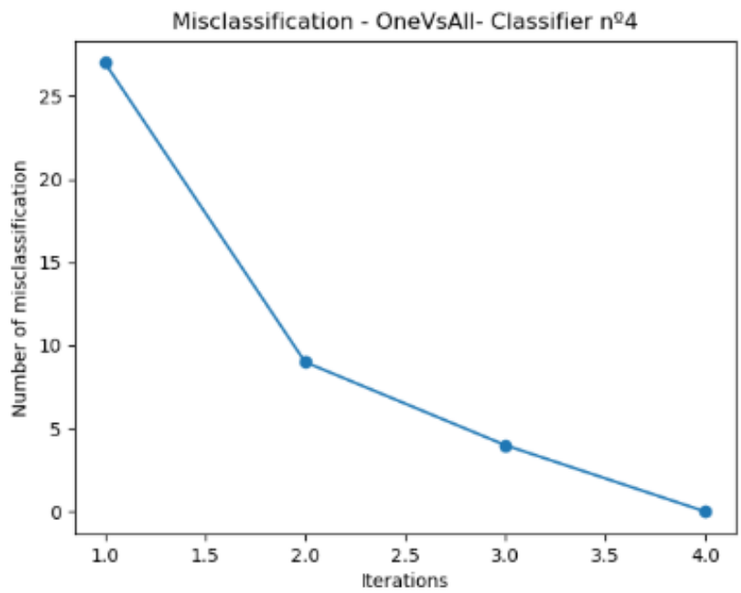

Figura 153: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

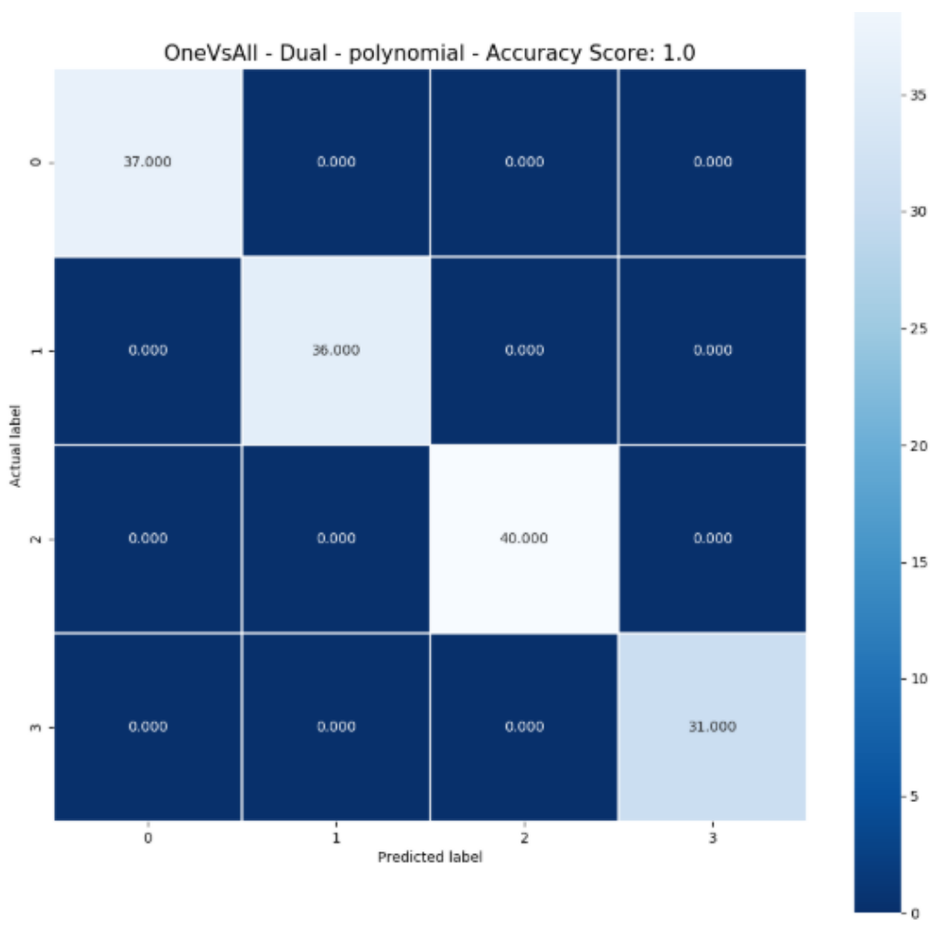

Figura 154: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

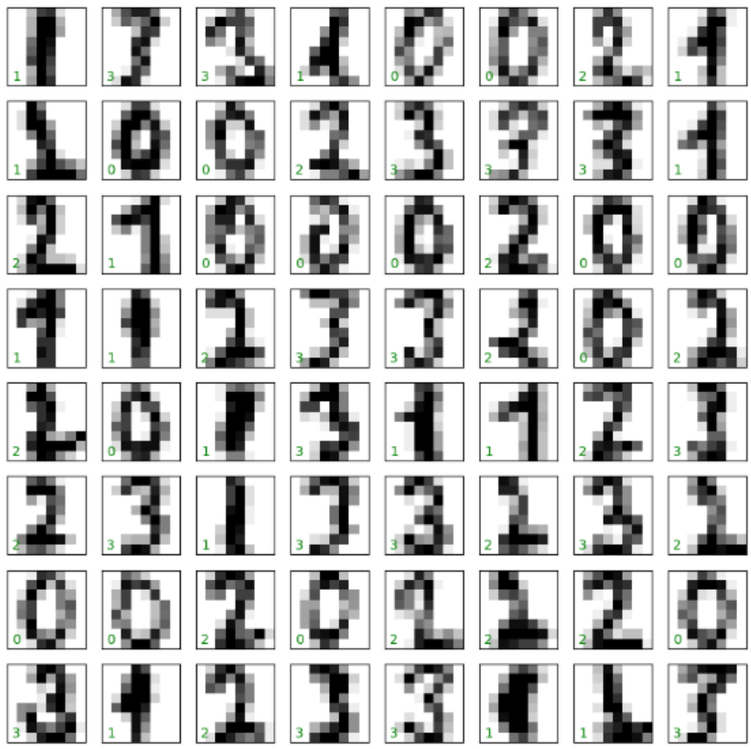

Figura 155: *OneVsAll* — *Predictions* utilizando o *Dataset Digits*

2.11 *Perceptron* Dual com *Kernel* Polinomial com *OVO*

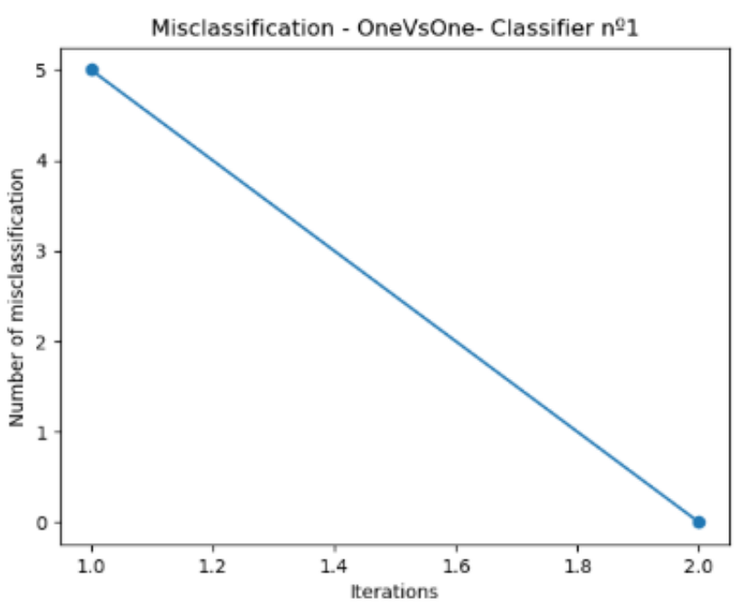

Figura 156: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

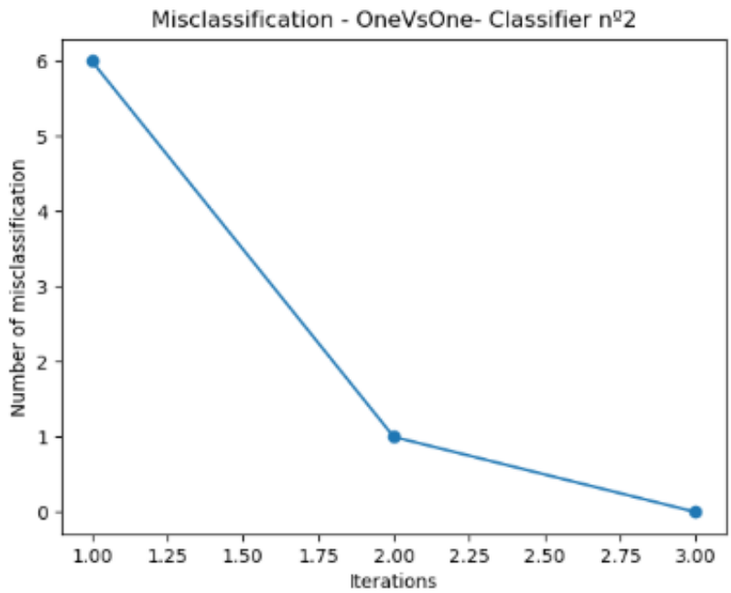

Figura 157: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

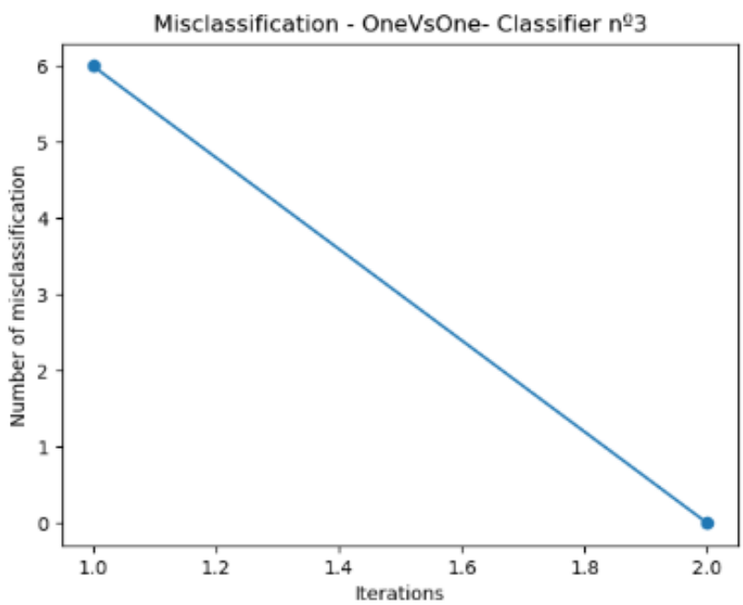

Figura 158: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

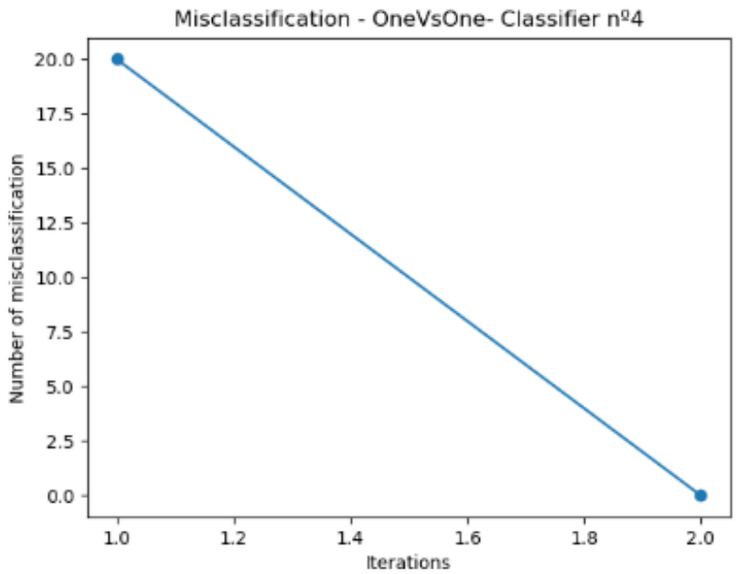

Figura 159: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

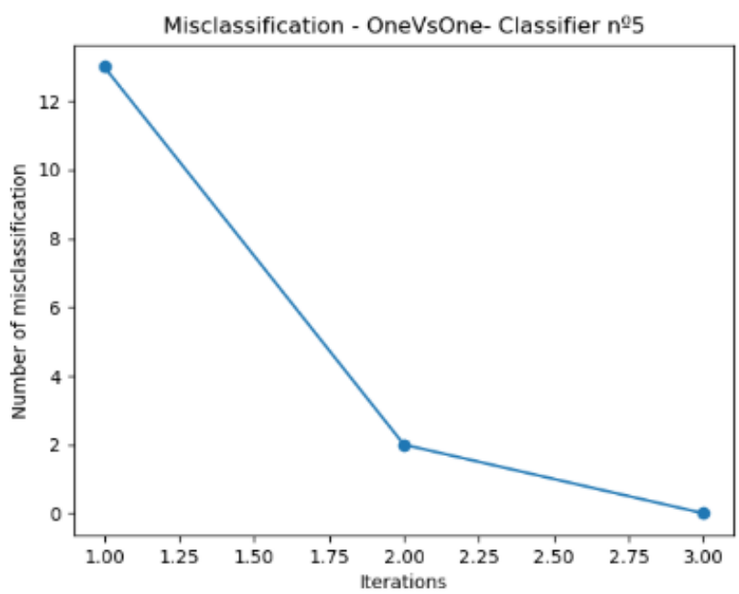

Figura 160: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

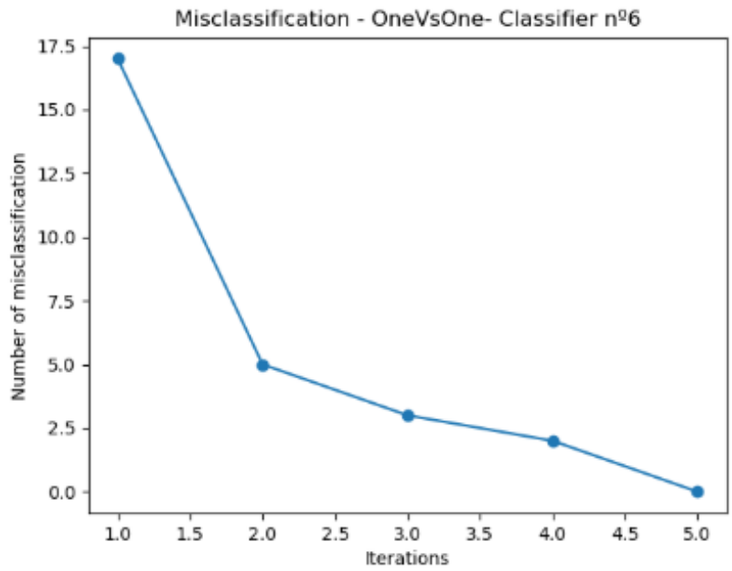

Figura 161: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

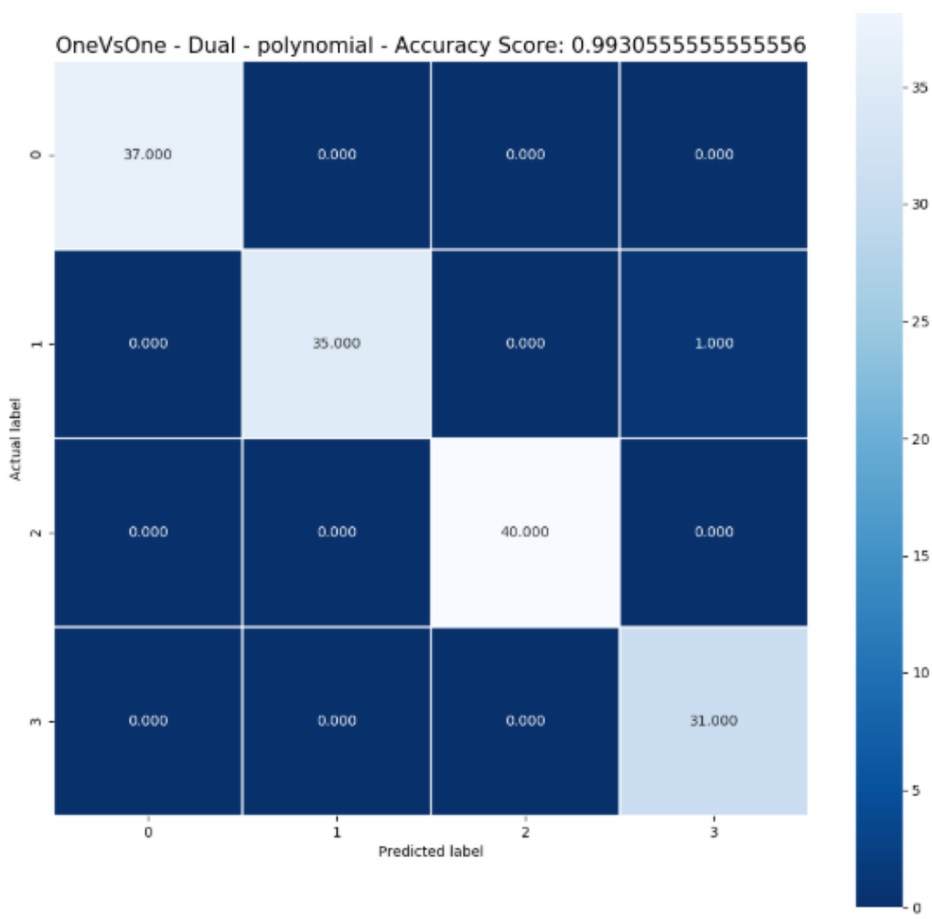

Figura 162: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

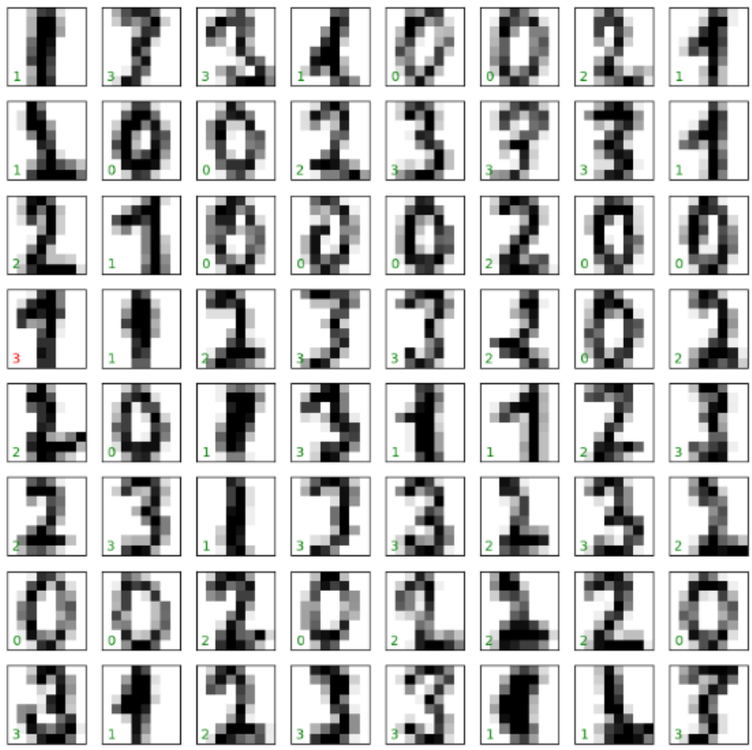

Figura 163: *OneVsOne* — *Predictions* utilizando o *Dataset Digits*

2.12 *Perceptron* Dual com *Kernel* Polinomial com *ECOC*

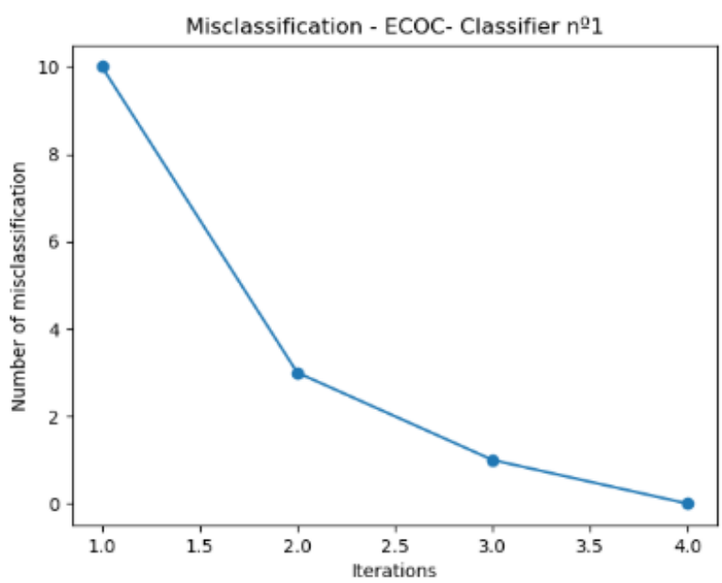

Figura 164: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

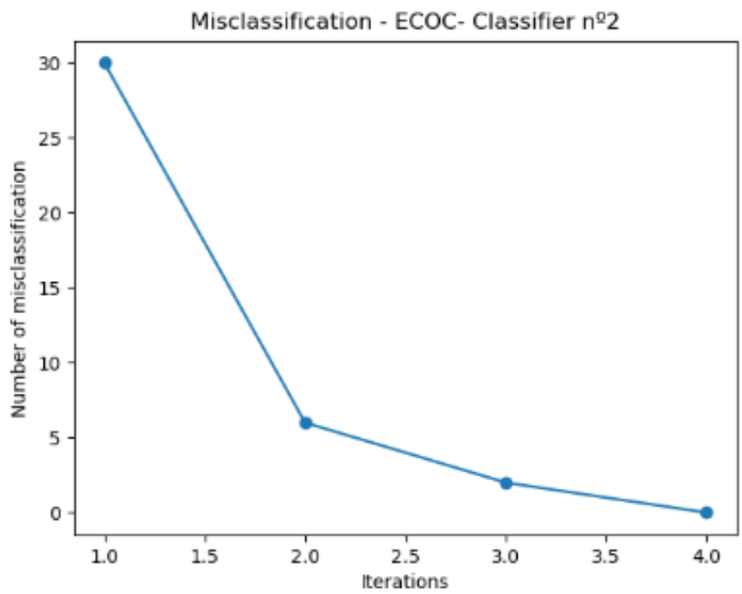

Figura 165: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

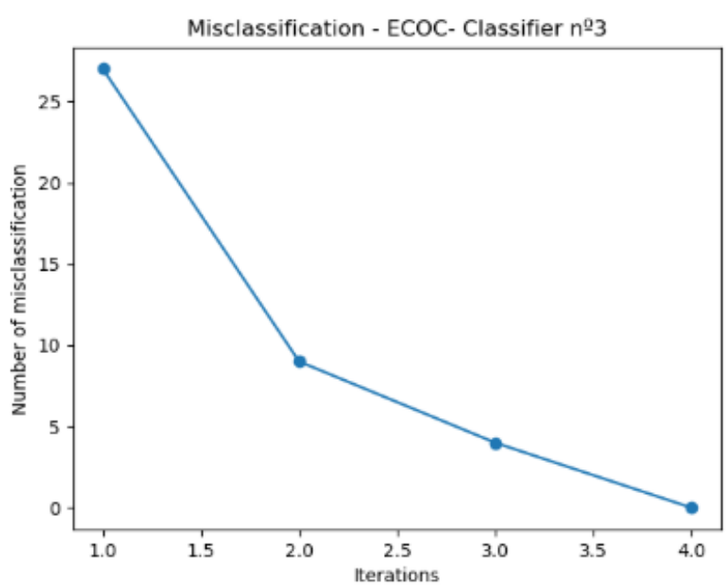

Figura 166: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

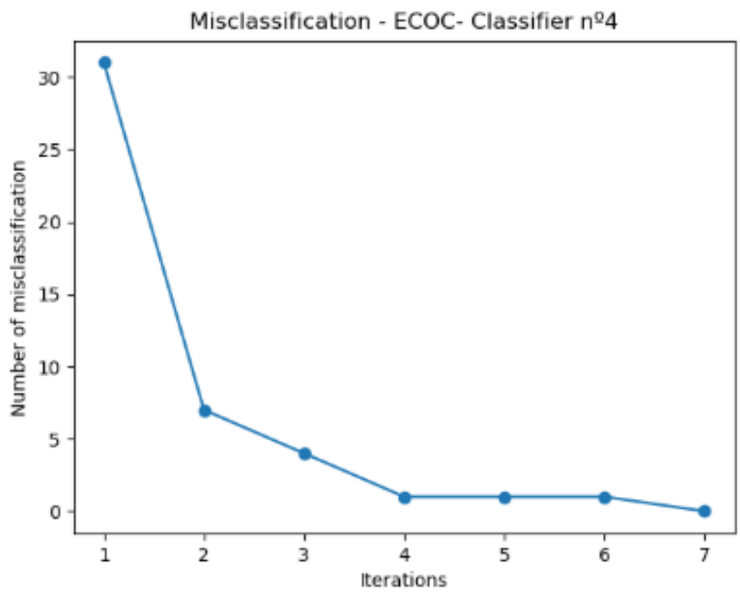

Figura 167: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

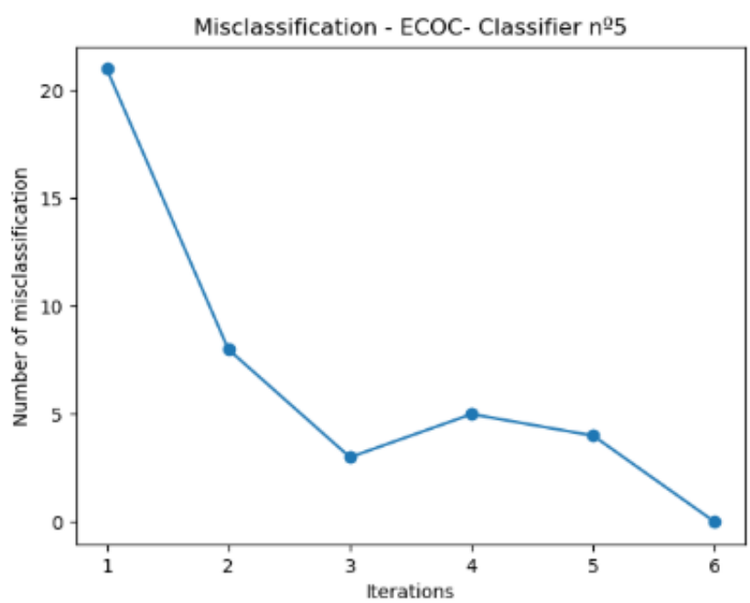

Figura 168: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

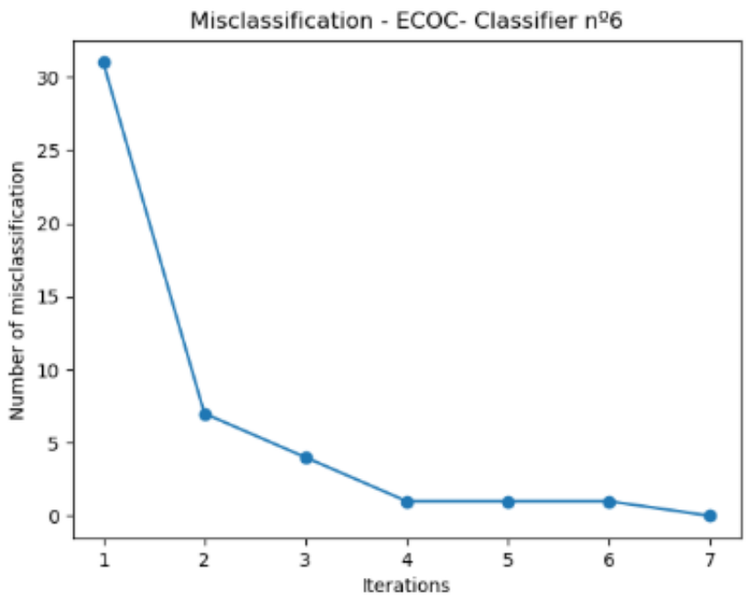

Figura 169: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

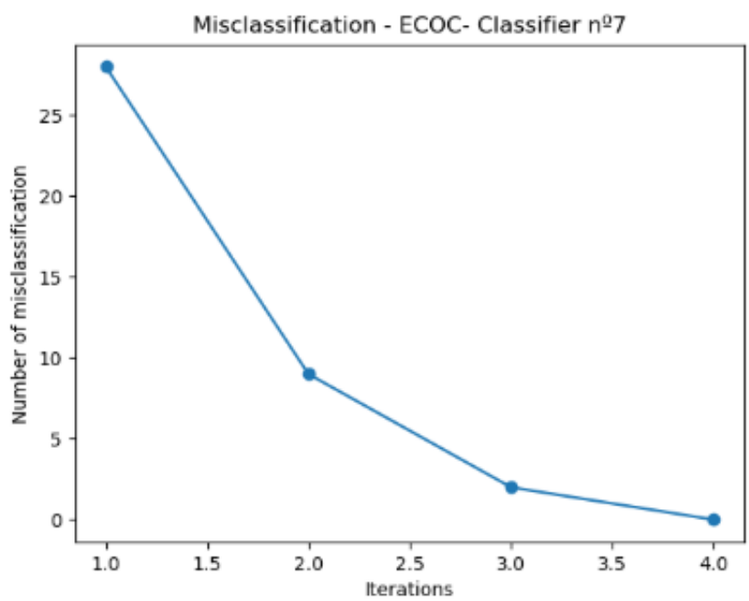

Figura 170: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

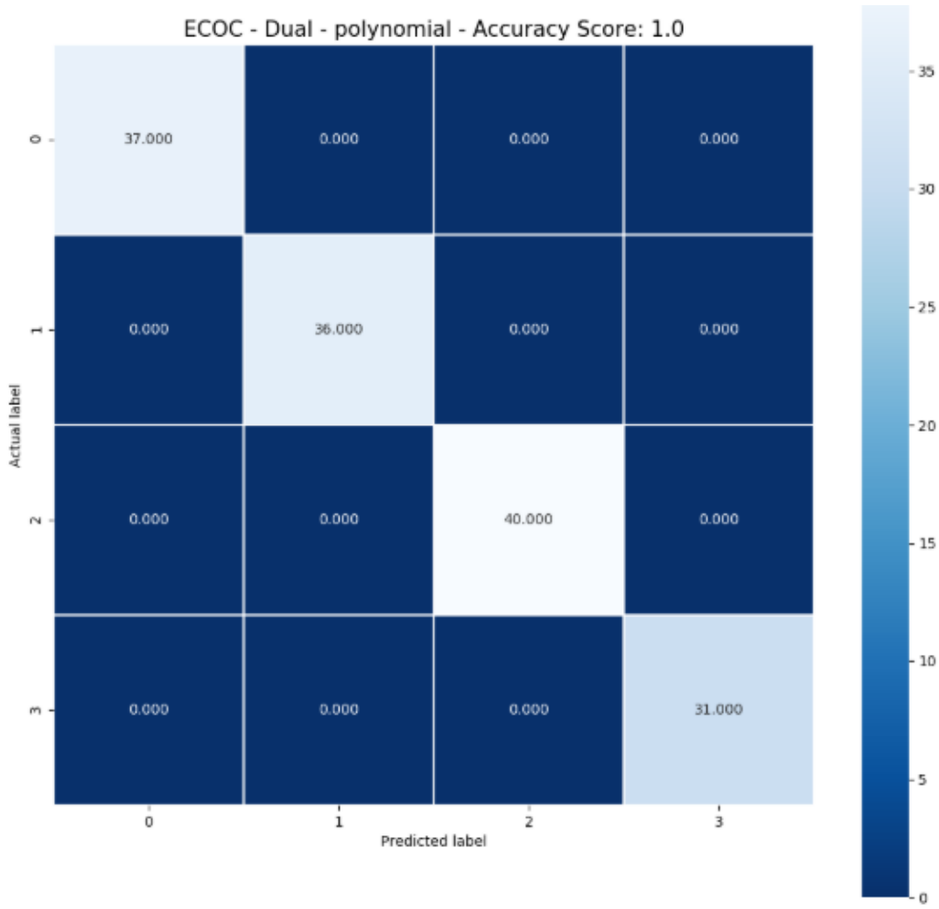

Figura 171: *ECOC — Accuracy* utilizando o *Dataset Digits*

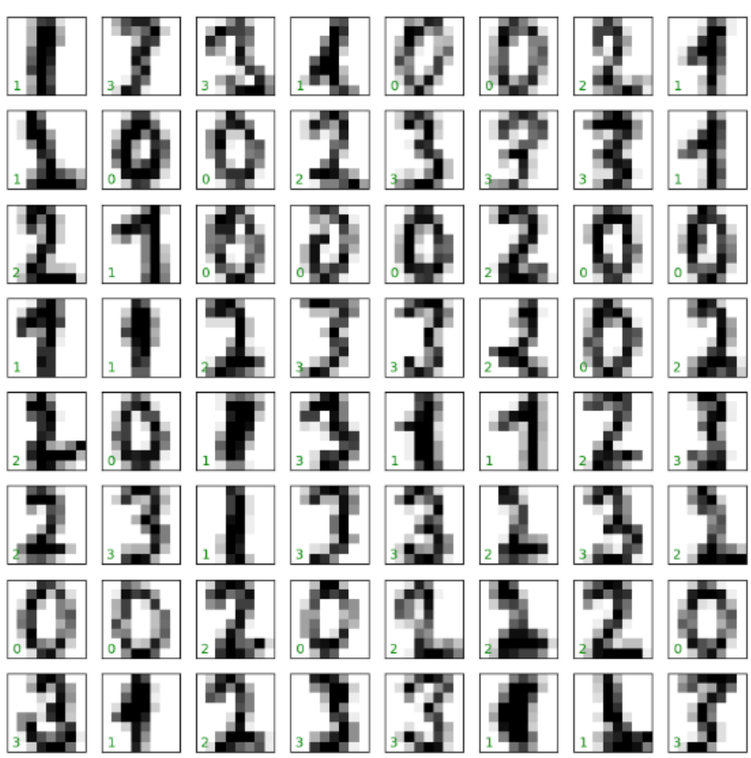

Figura 172: *ECOC — Predictions* utilizando o *Dataset Digits*

3 Resultados com *Dataset Mnist* para as classes 3679

3.1 *Perceptron* Primal com *OVA*

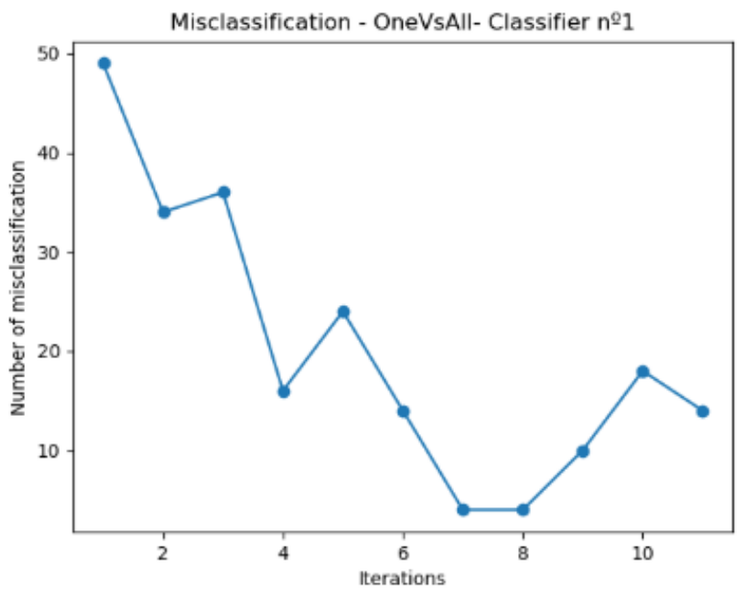

Figura 173: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

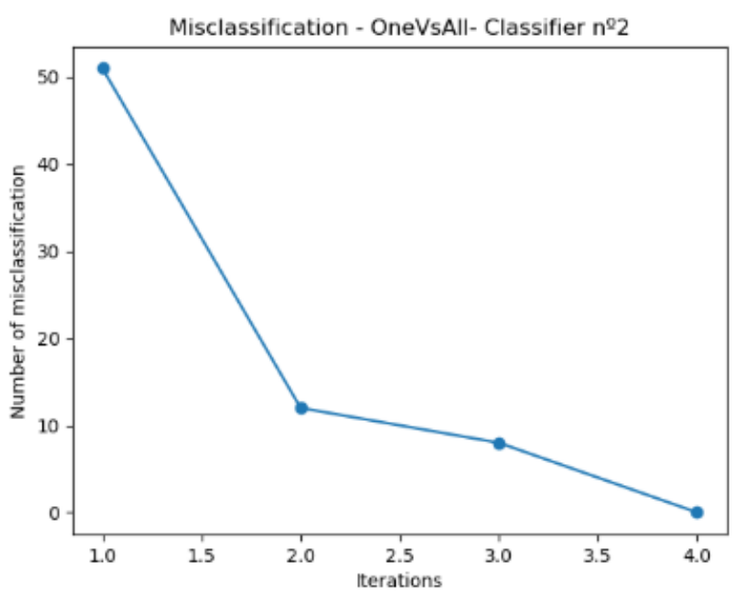

Figura 174: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

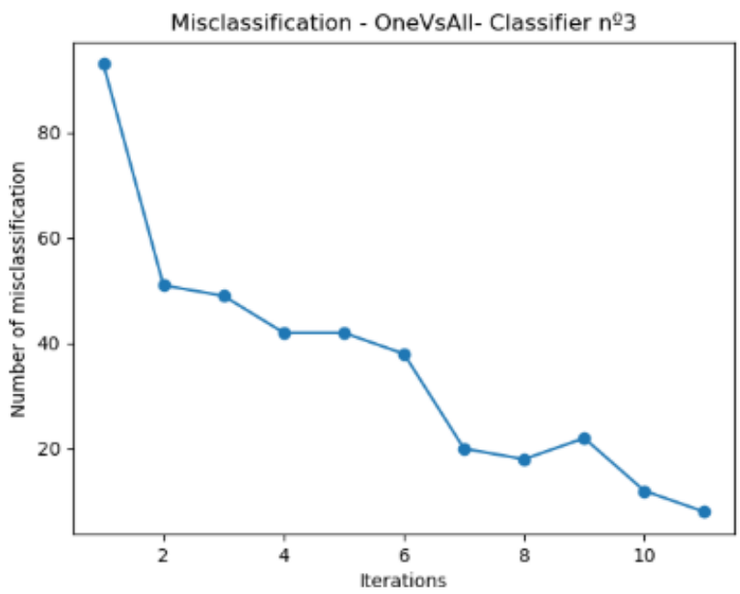

Figura 175: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

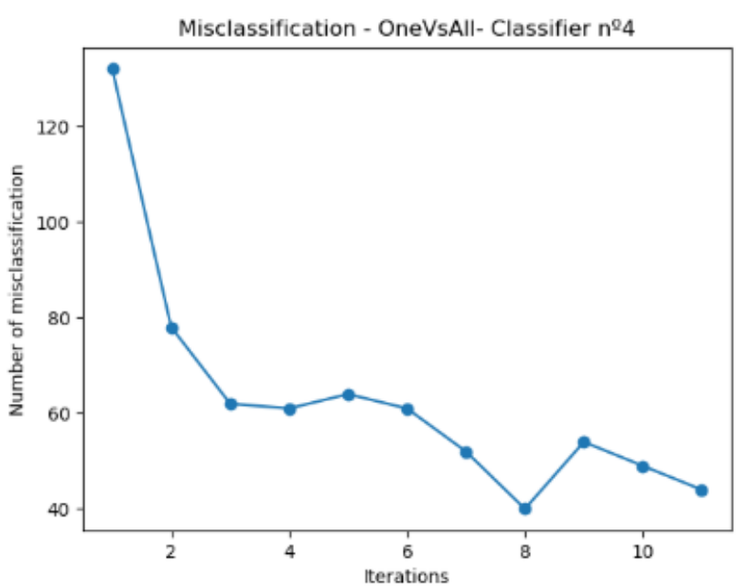

Figura 176: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

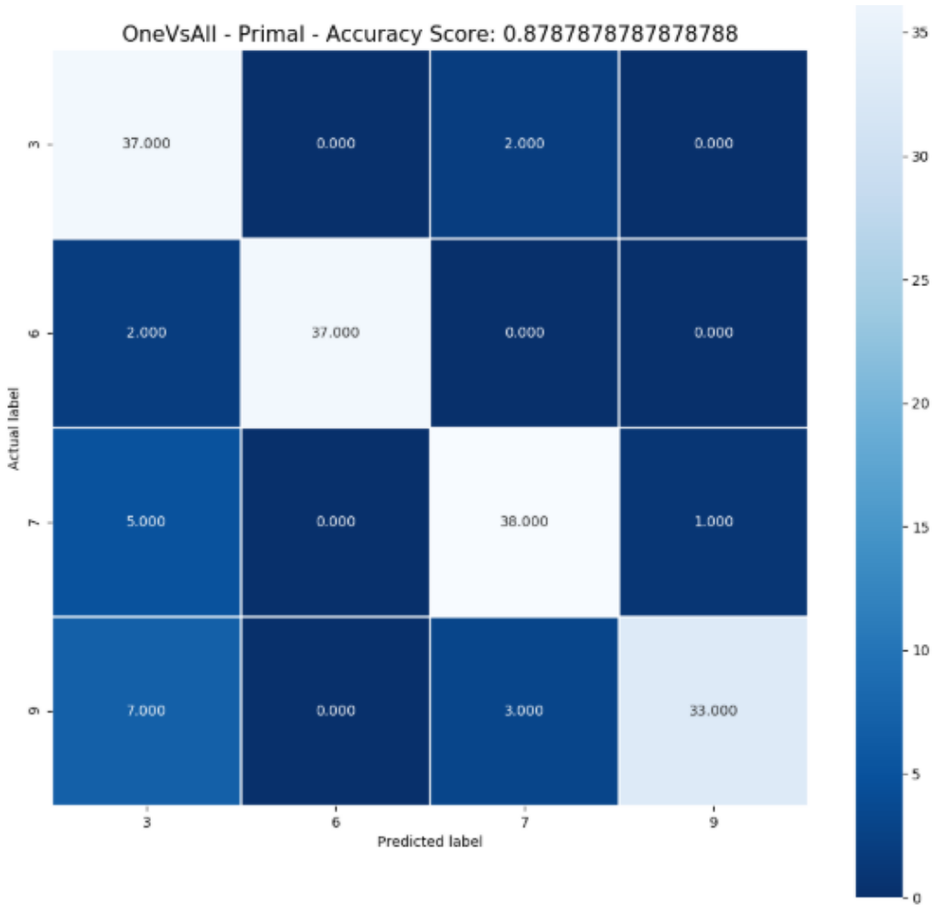

Figura 177: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

3.2 *Perceptron* Primal com *OVO*

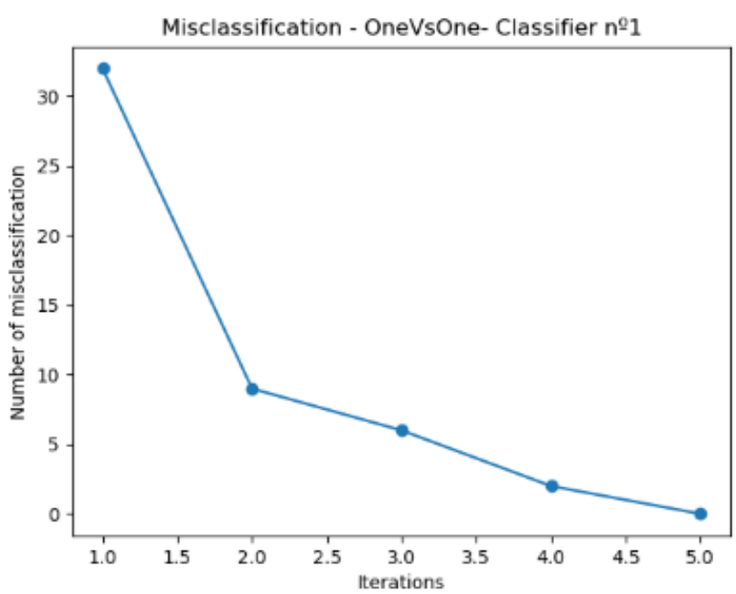

Figura 178: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

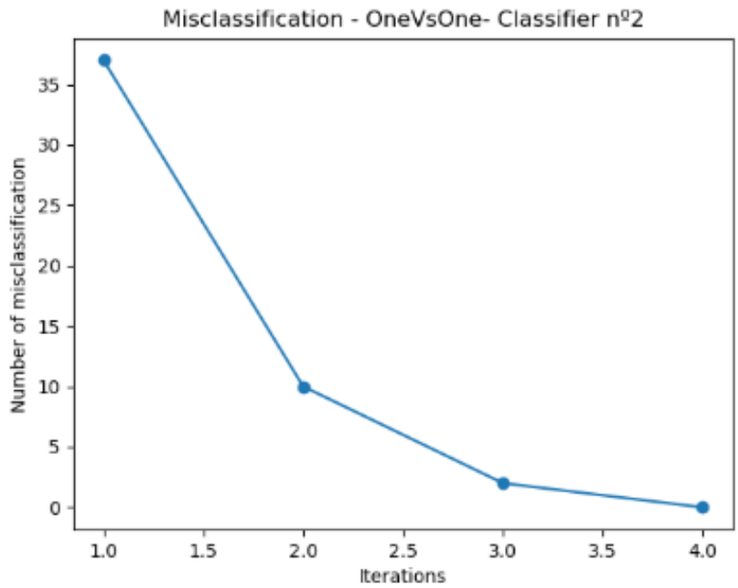

Figura 179: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

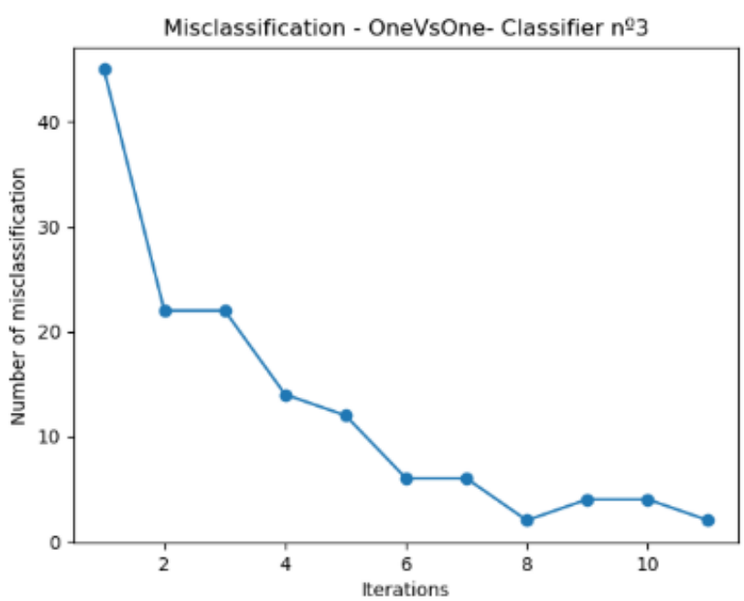

Figura 180: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

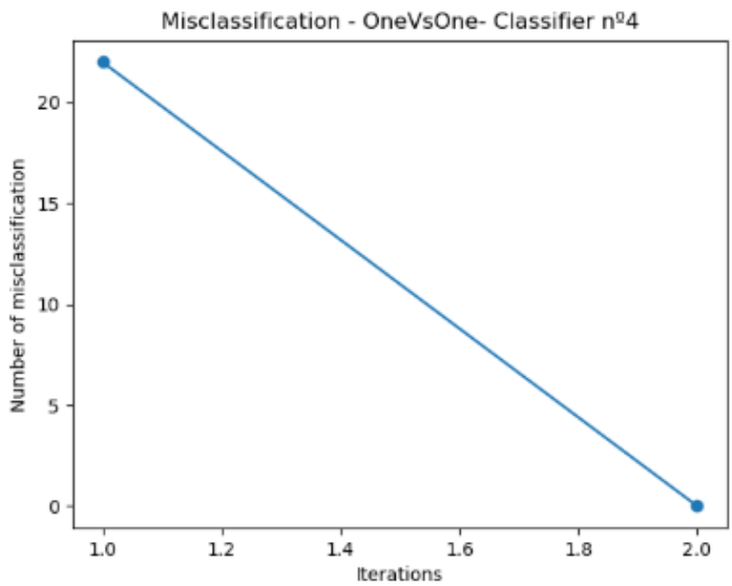

Figura 181: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

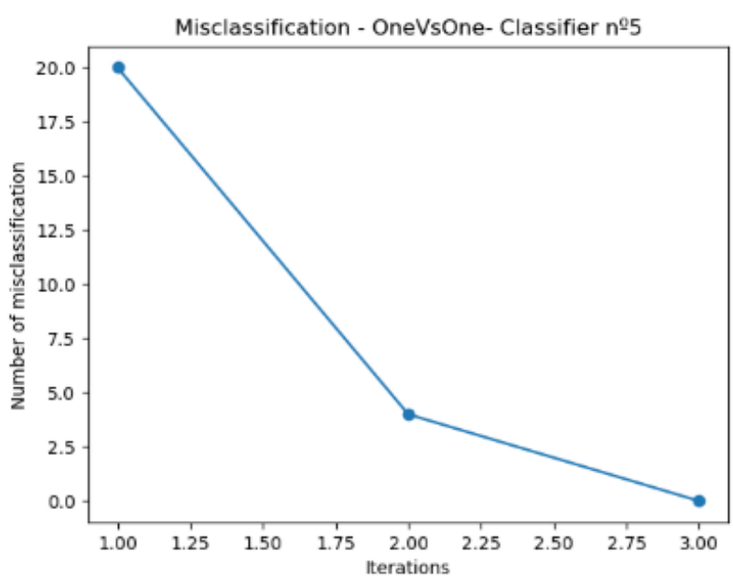

Figura 182: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

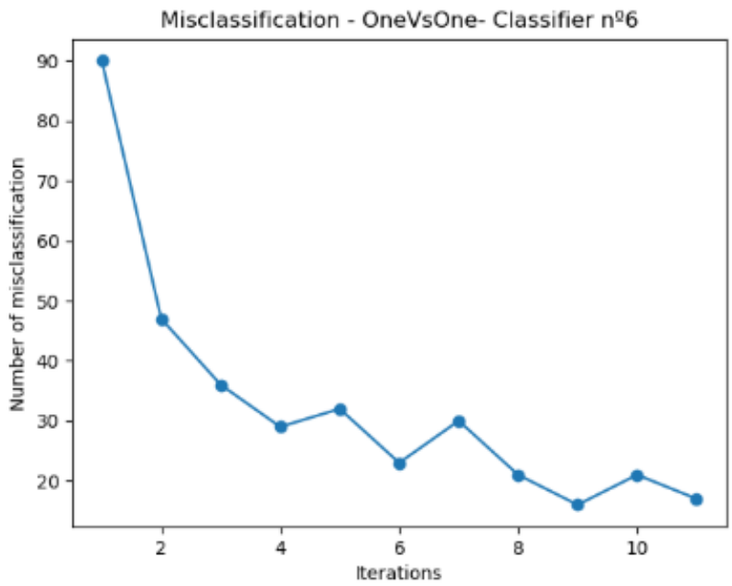

Figura 183: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

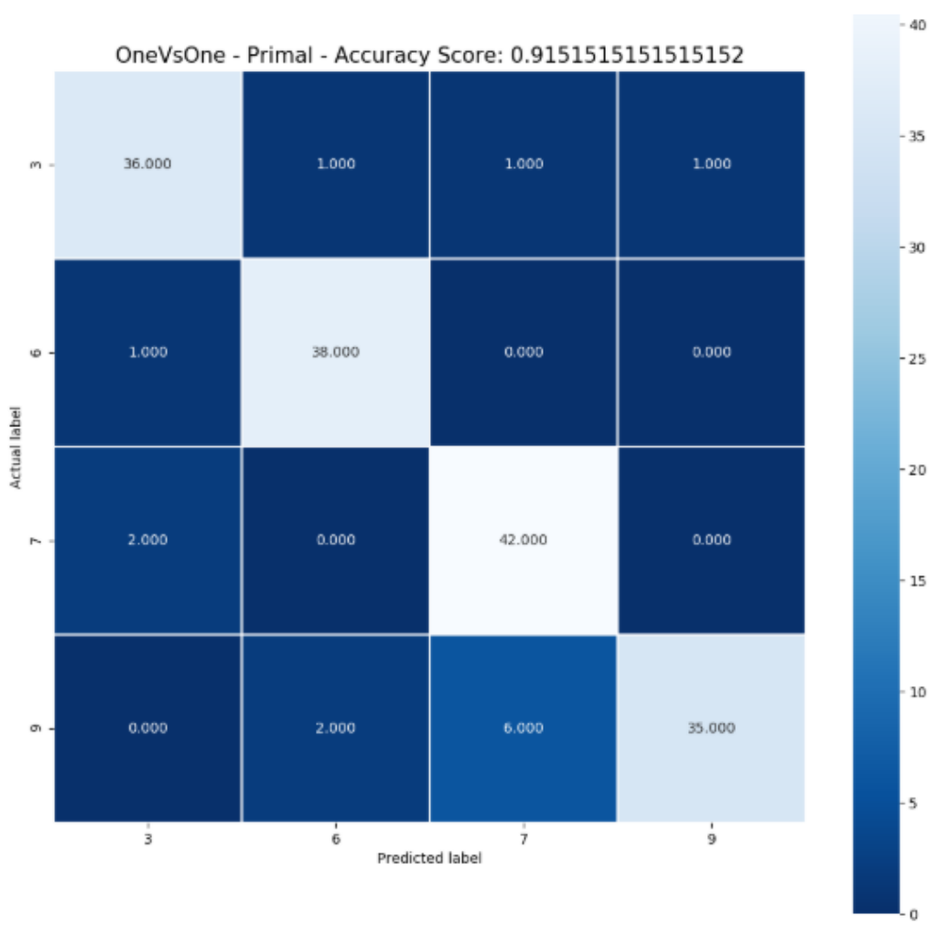

Figura 184: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

3.3 *Perceptron* Primal com *ECOC*

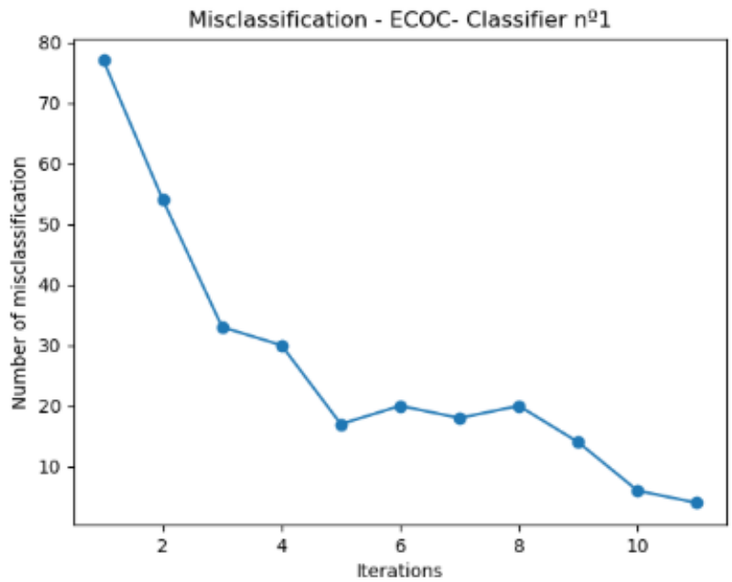

Figura 185: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

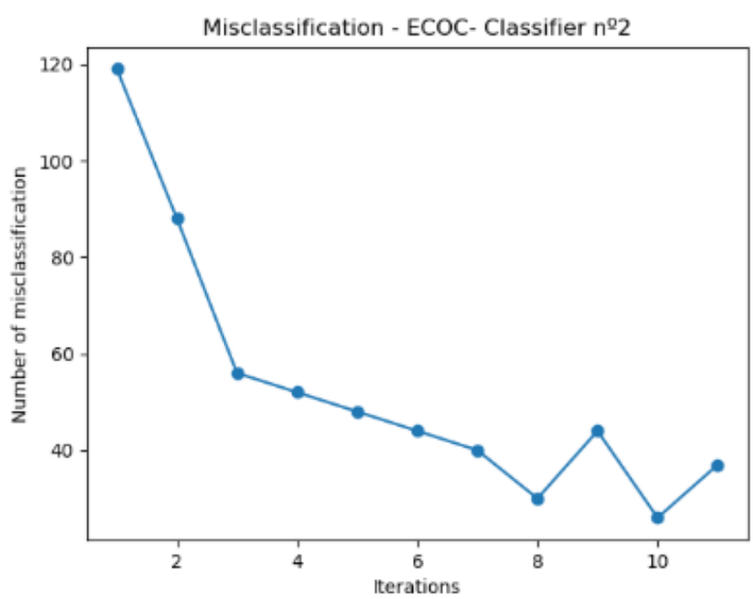

Figura 186: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

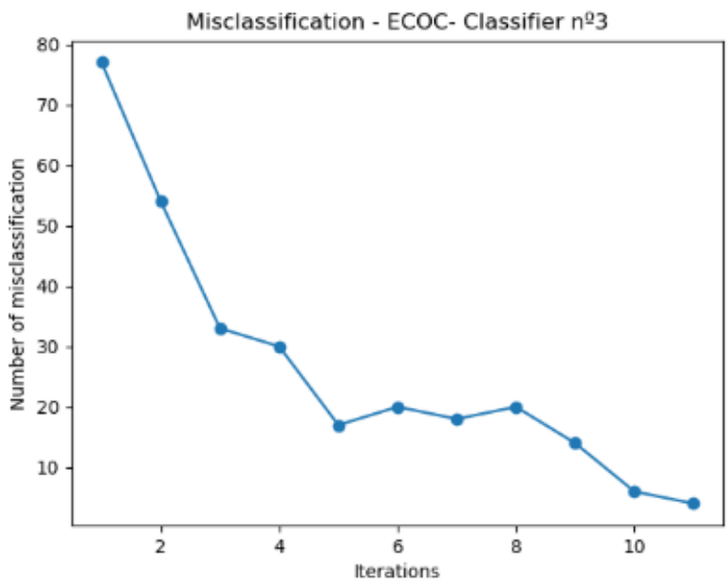

Figura 187: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

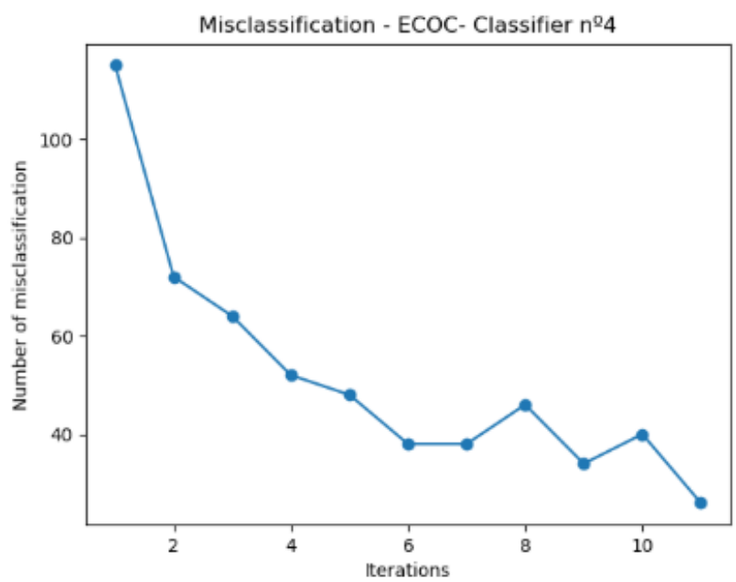

Figura 188: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

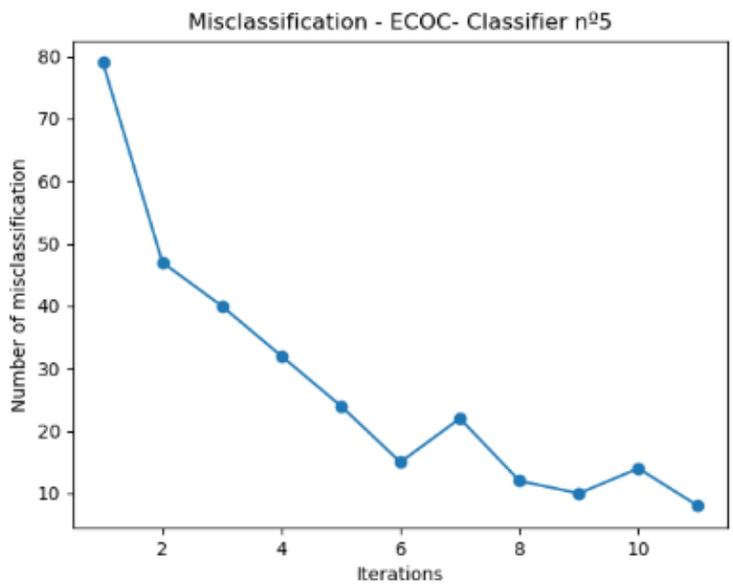

Figura 189: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

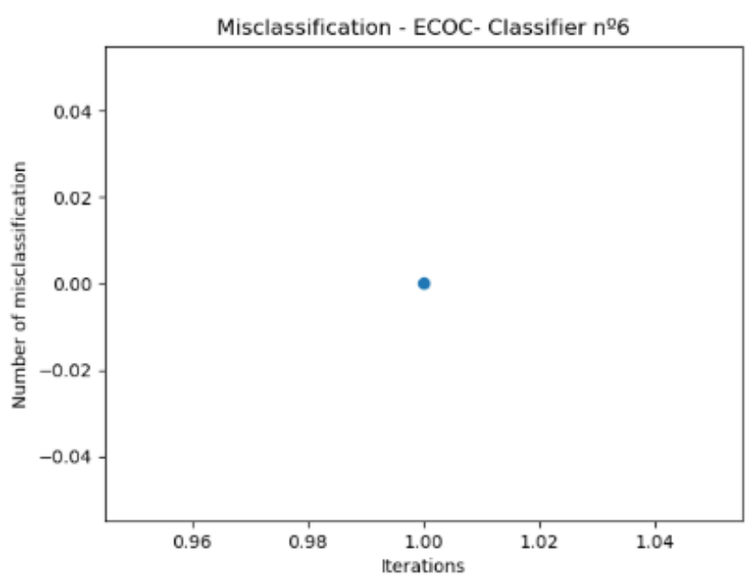

Figura 190: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

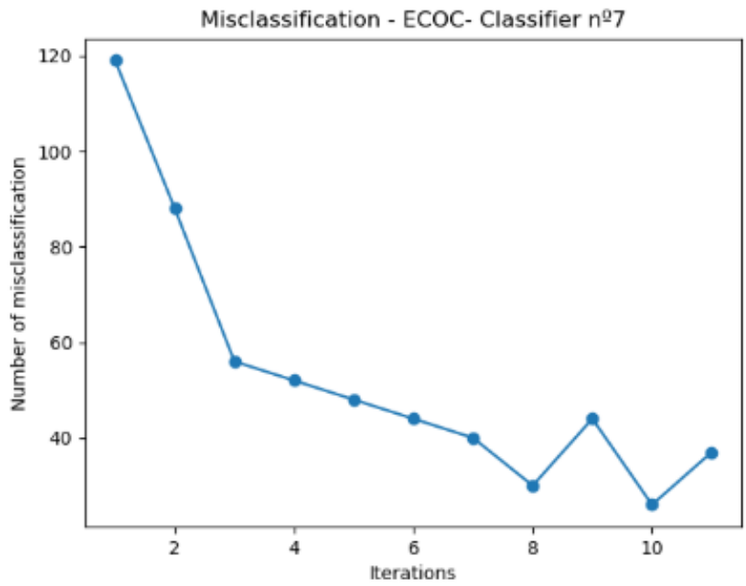

Figura 191: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

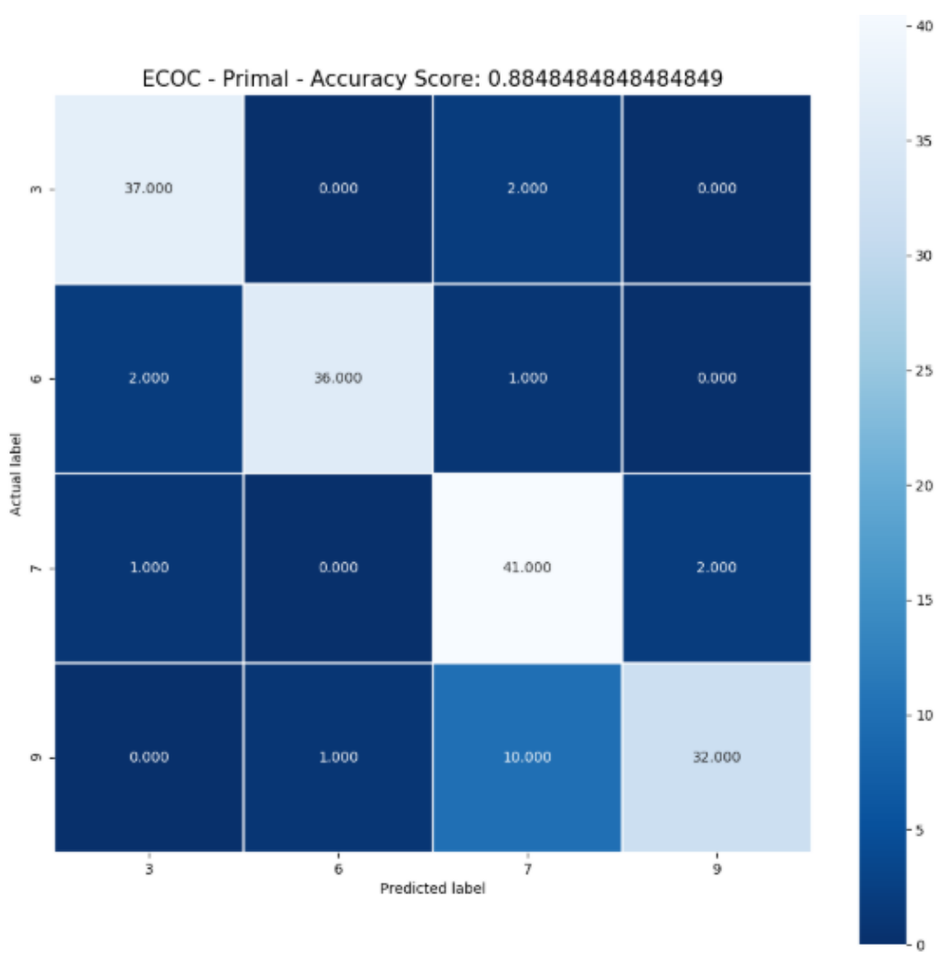

Figura 192: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

3.4 *Perceptron* Dual com *OVA*

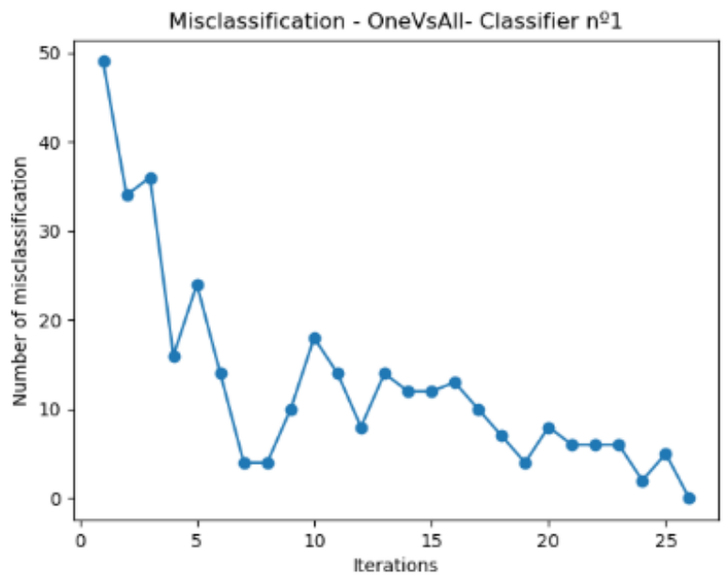

Figura 193: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

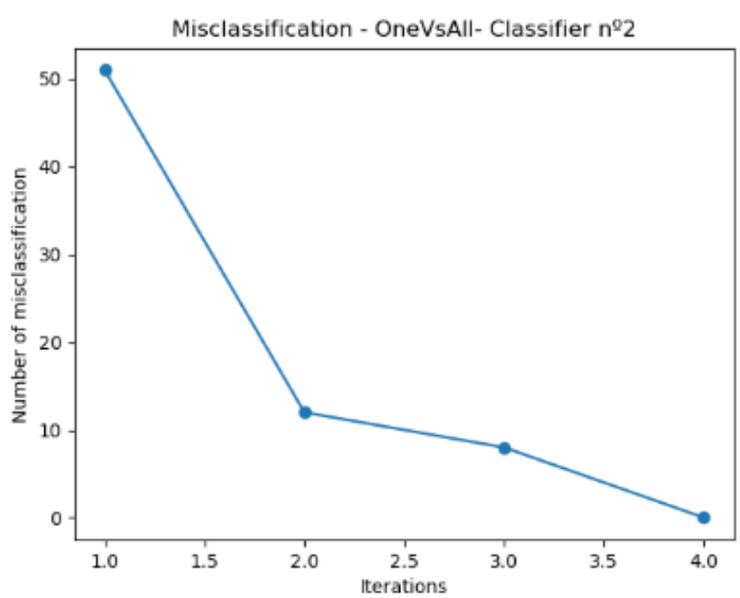

Figura 194: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

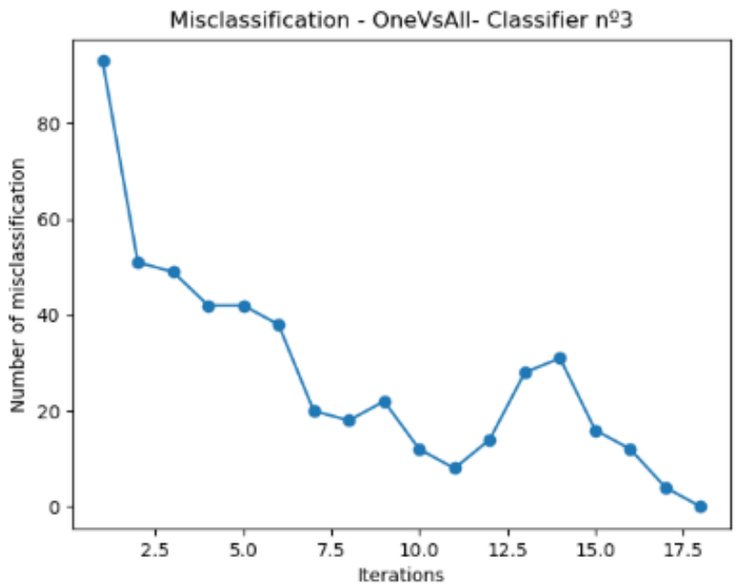

Figura 195: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

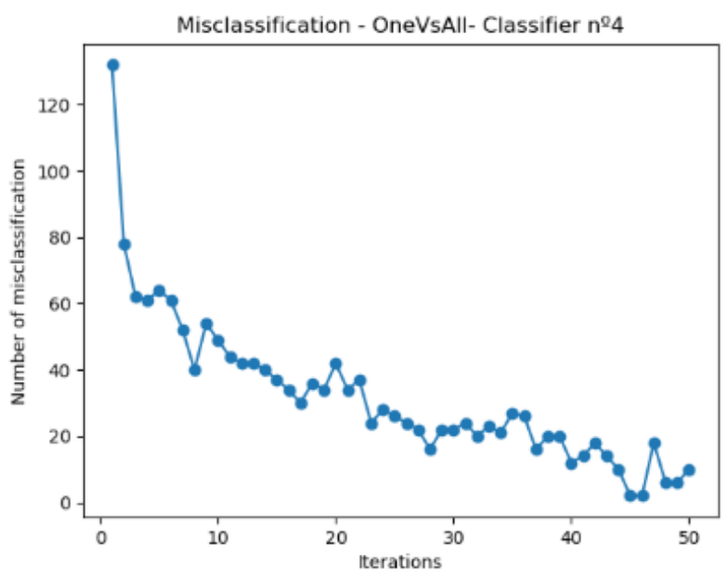

Figura 196: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

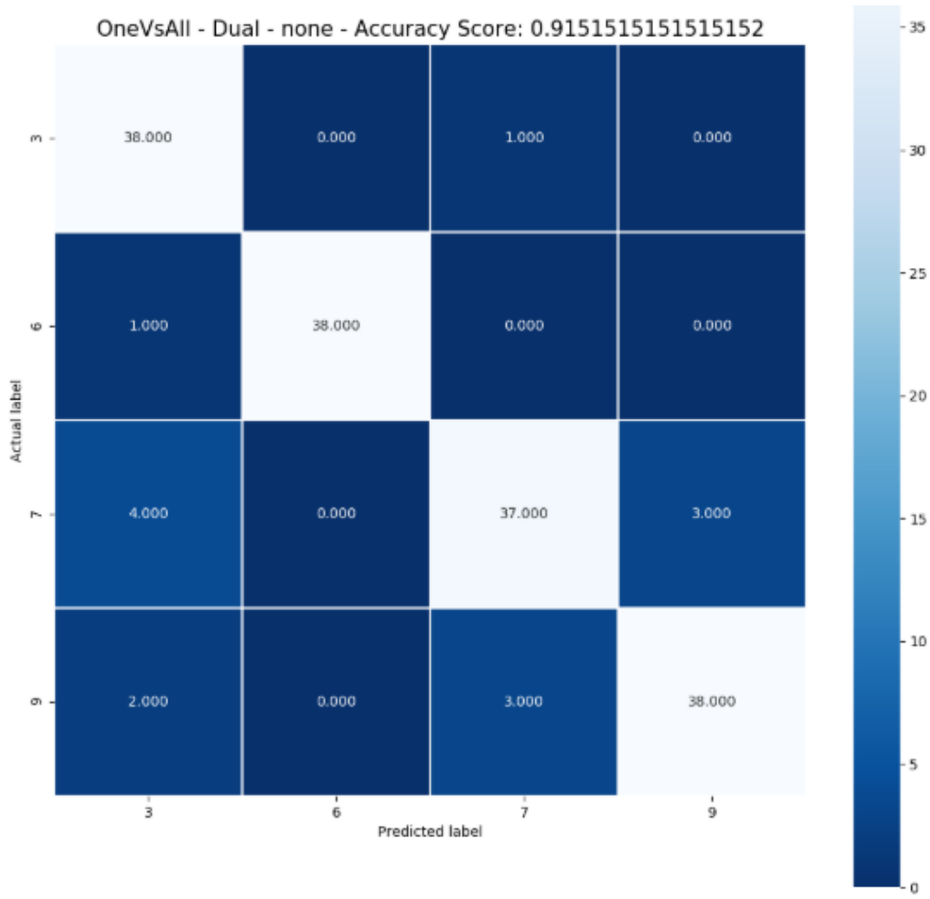

Figura 197: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

3.5 *Perceptron* Dual com *OVO*

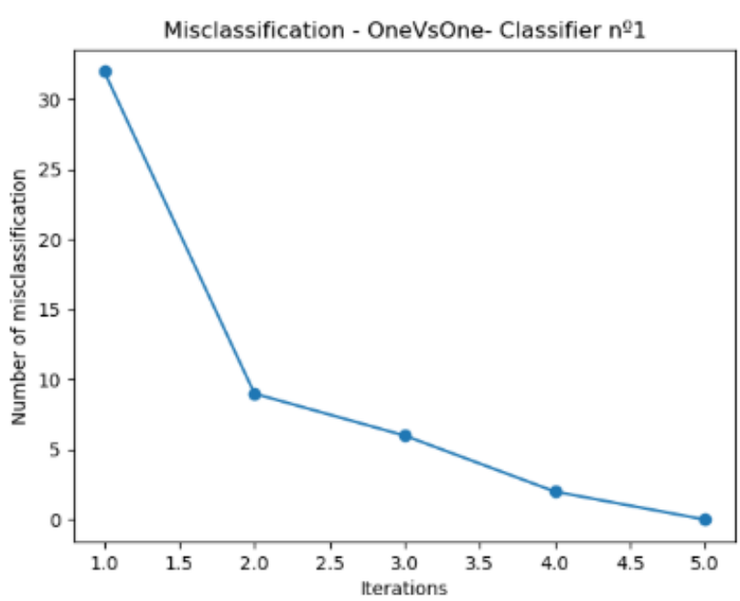

Figura 198: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

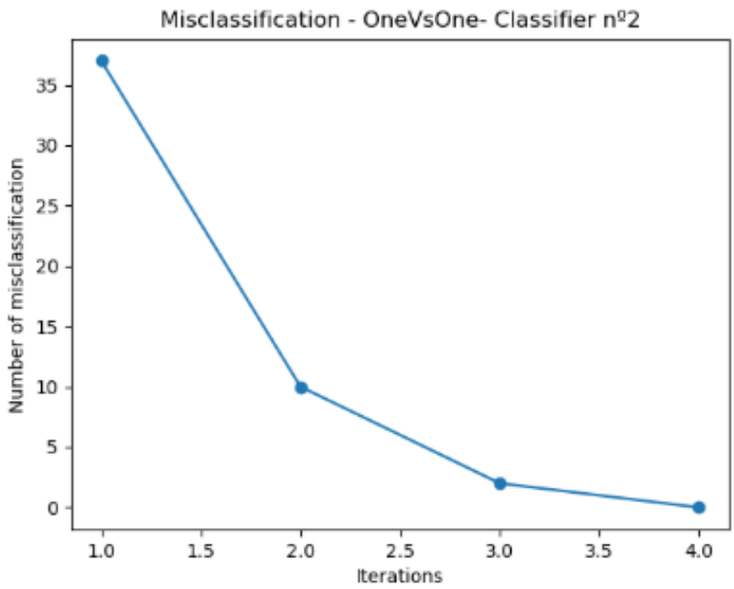

Figura 199: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

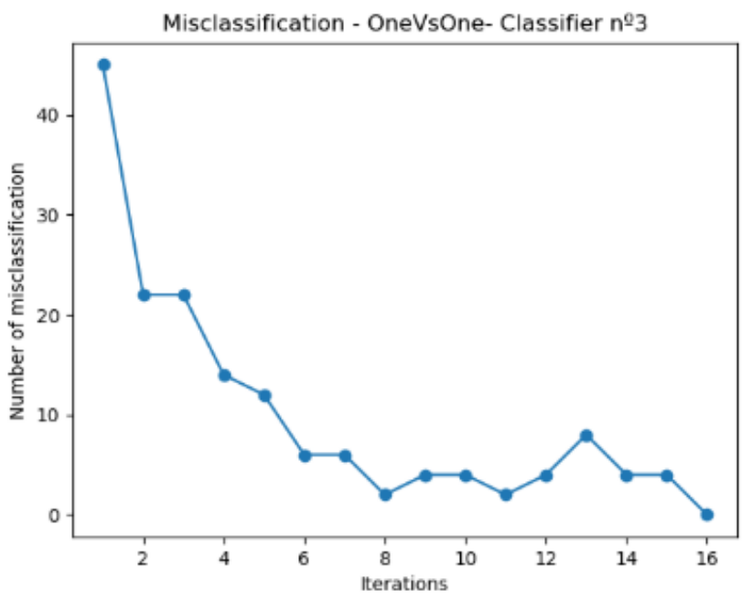

Figura 200: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

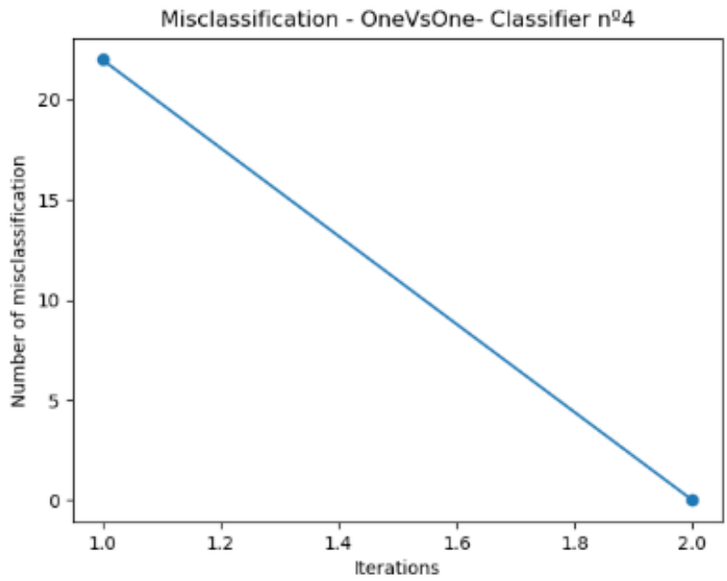

Figura 201: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

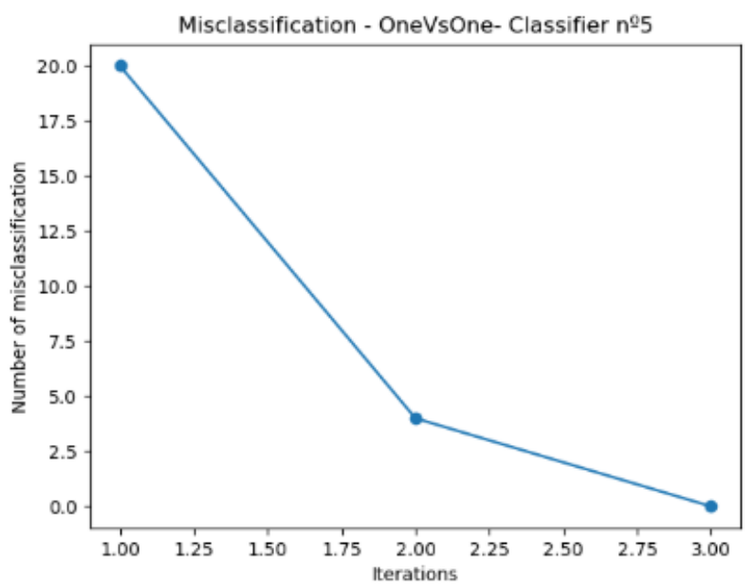

Figura 202: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

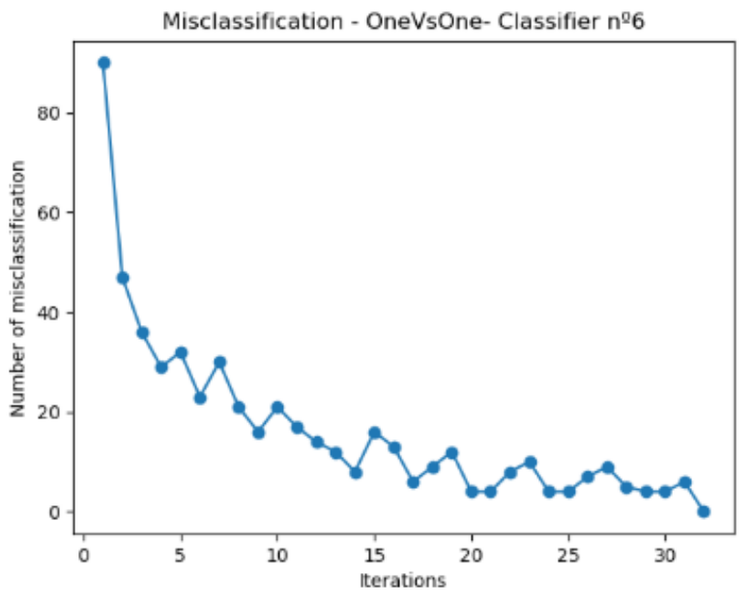

Figura 203: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

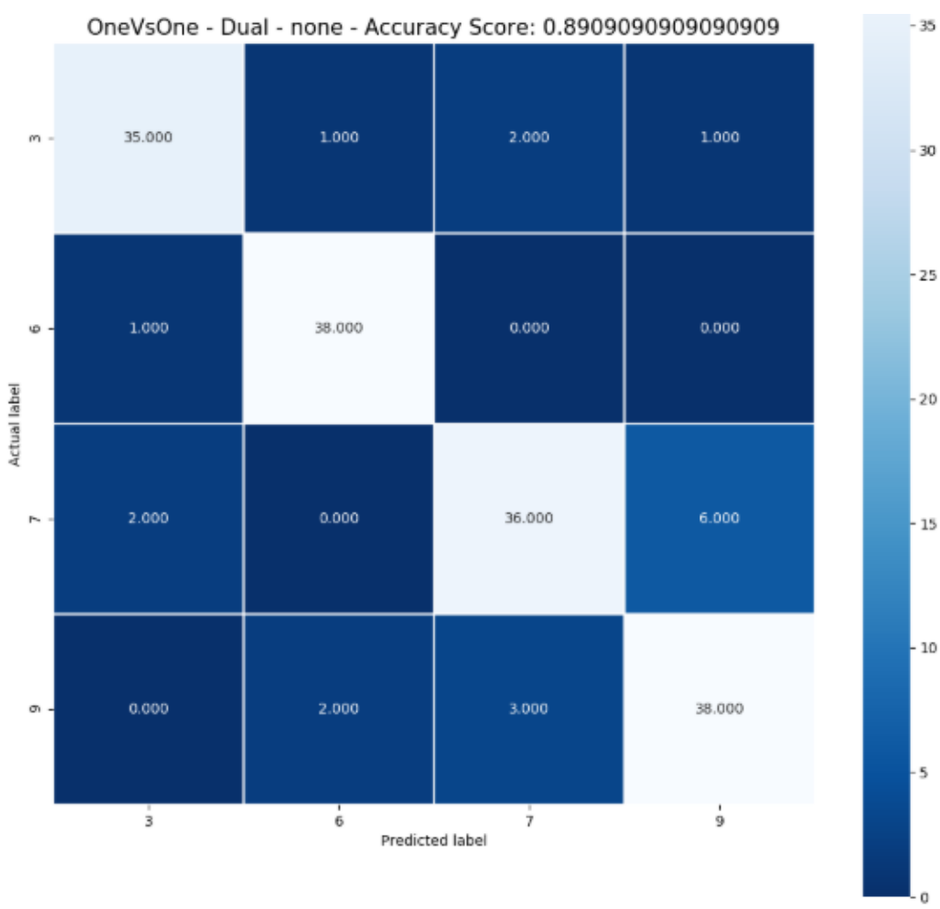

Figura 204: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

3.6 *Perceptron* Dual com *ECOC*

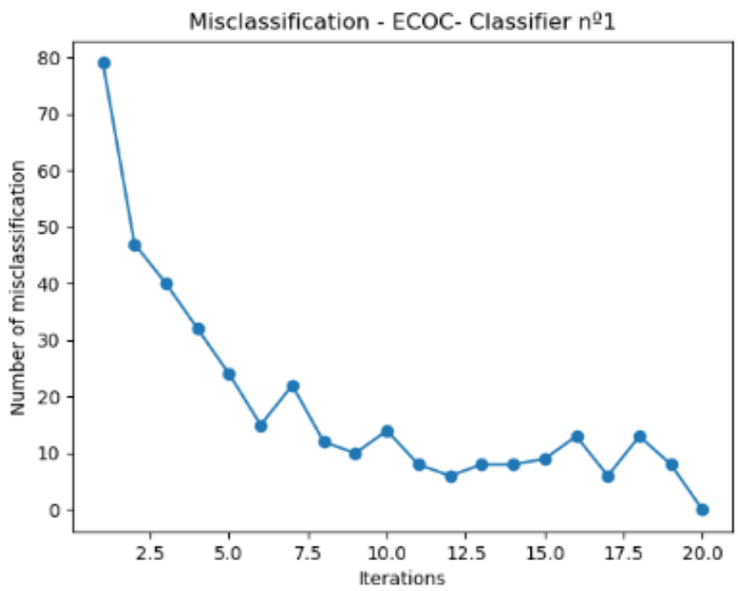

Figura 205: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

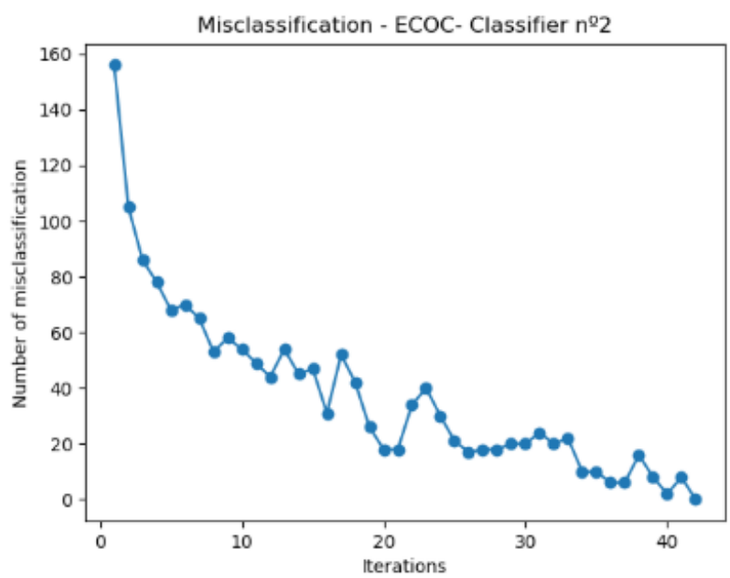

Figura 206: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

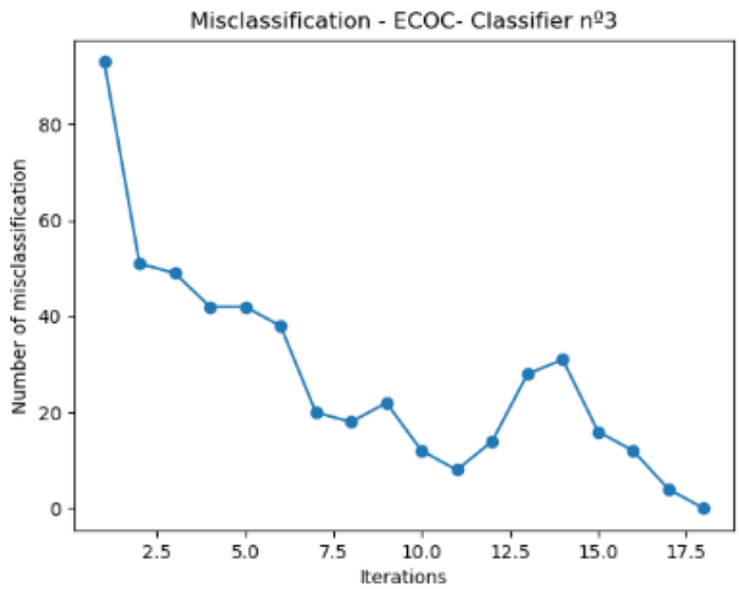

Figura 207: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

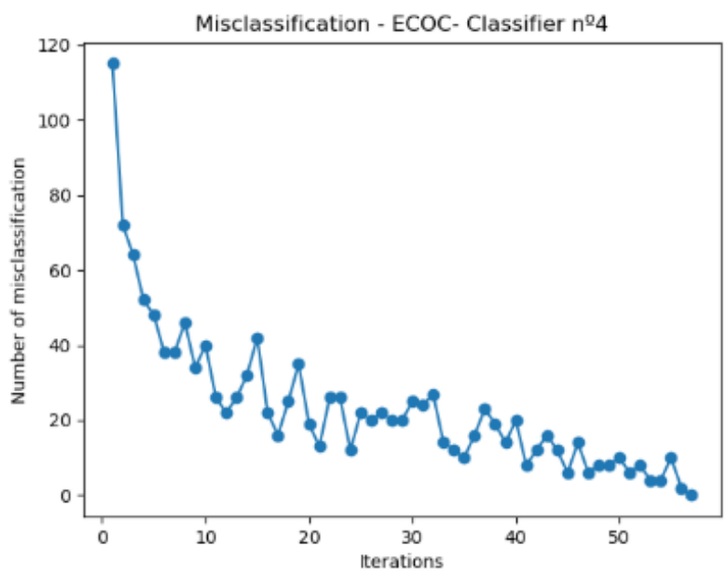

Figura 208: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

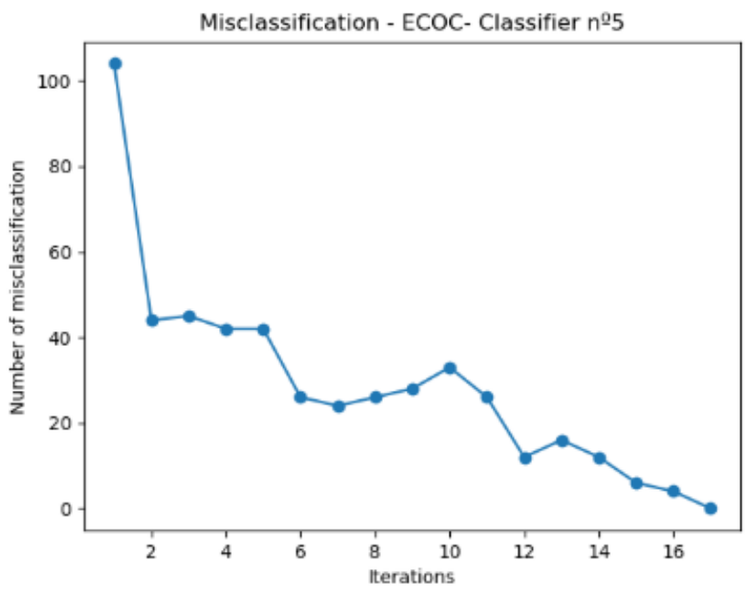

Figura 209: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

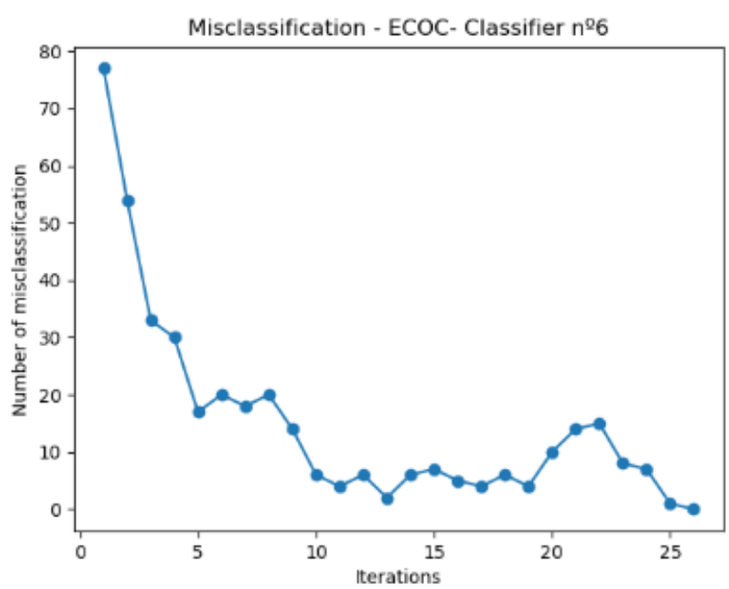

Figura 210: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

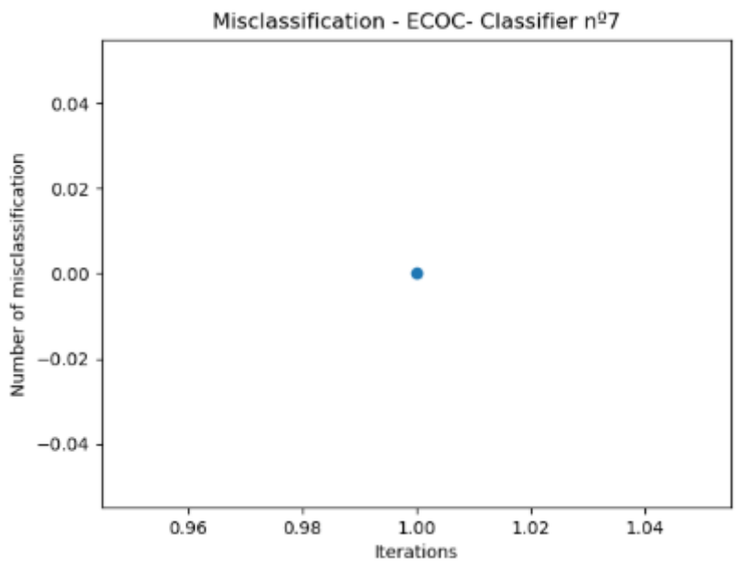

Figura 211: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

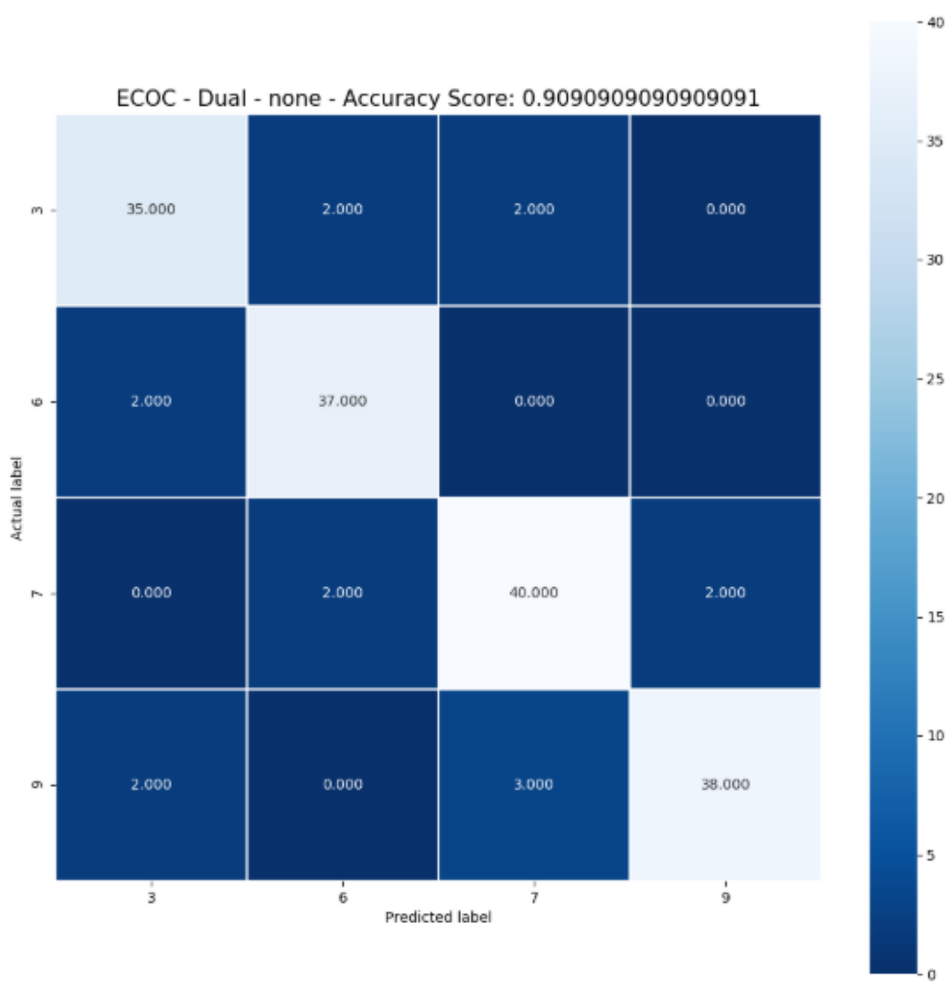

Figura 212: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

3.7 *Perceptron* Dual com *Kernel RBF* com *OVA*

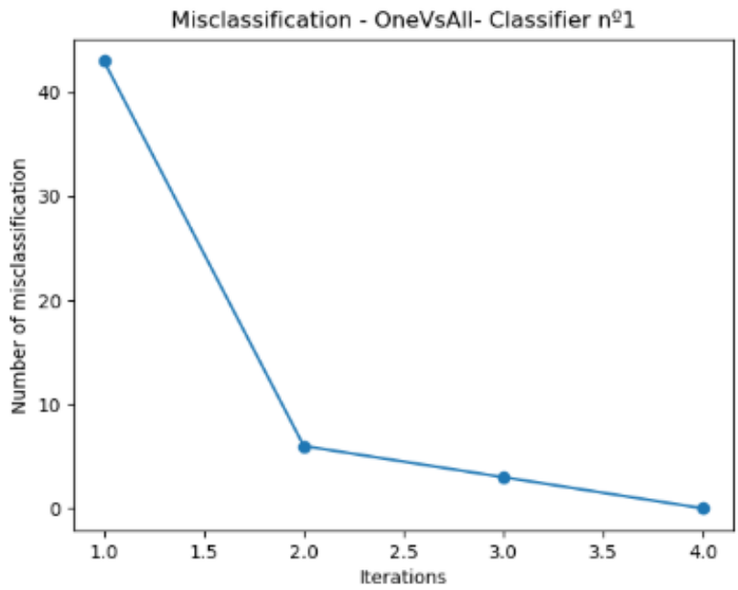

Figura 213: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

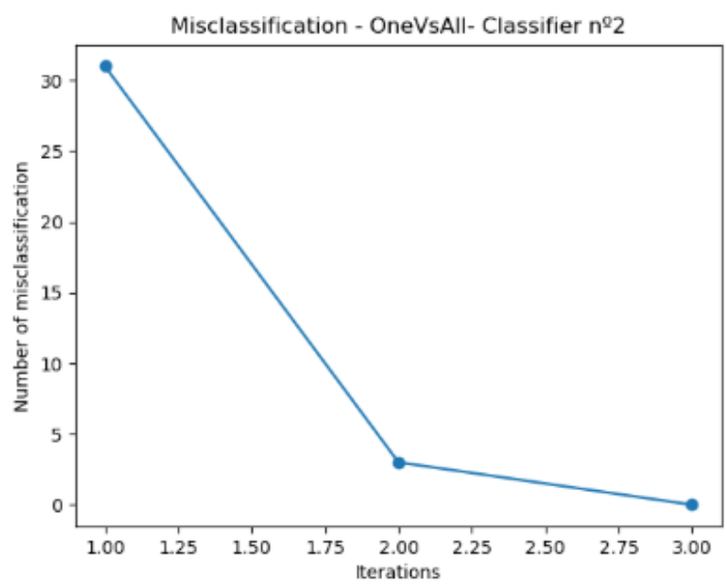

Figura 214: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

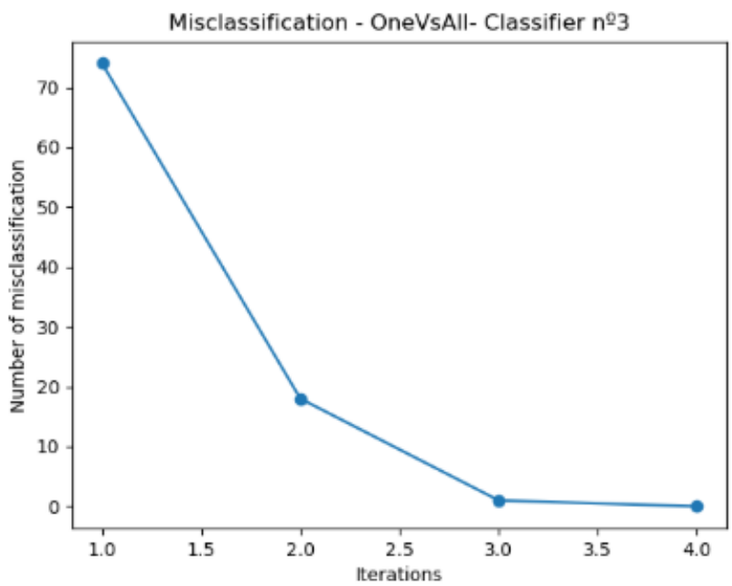

Figura 215: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

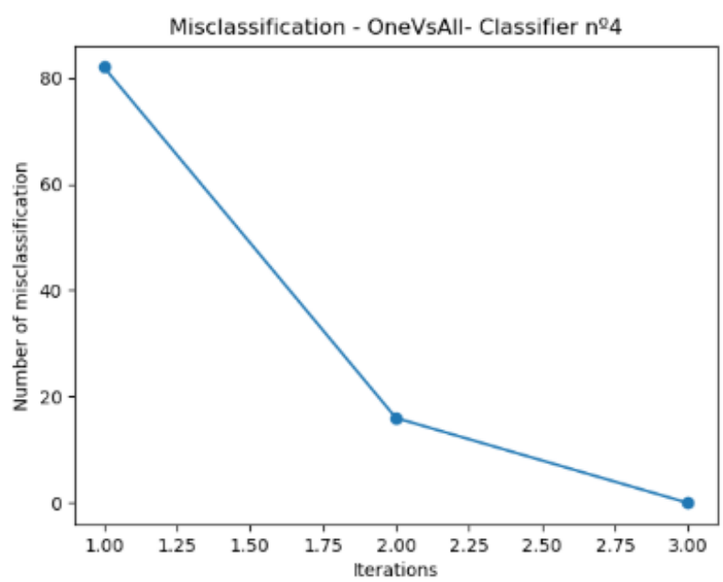

Figura 216: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

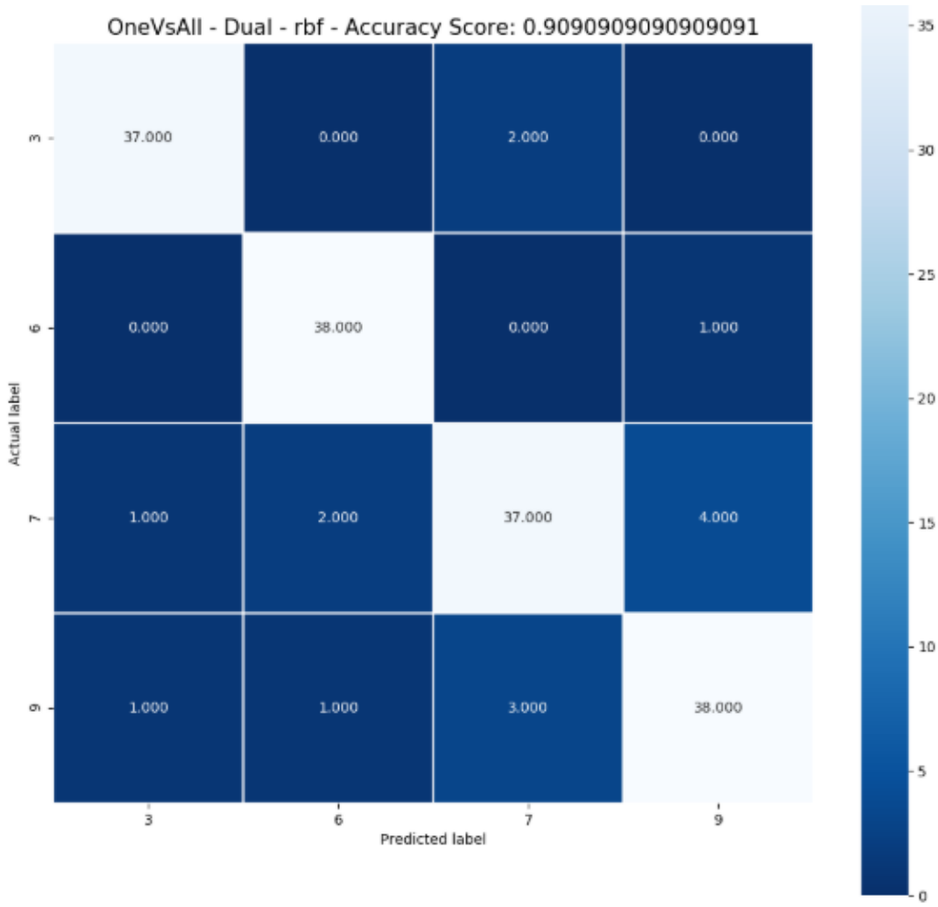

Figura 217: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

3.8 *Perceptron* Dual com *Kernel RBF* com *OVO*

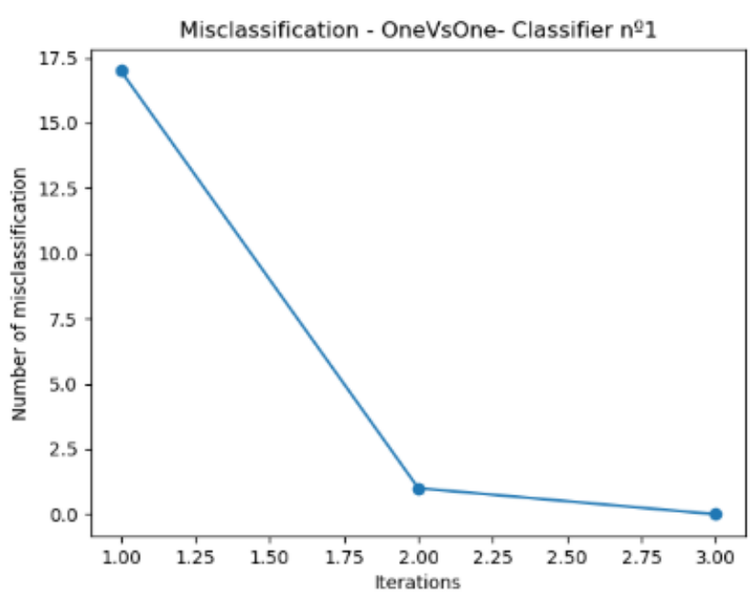

Figura 218: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

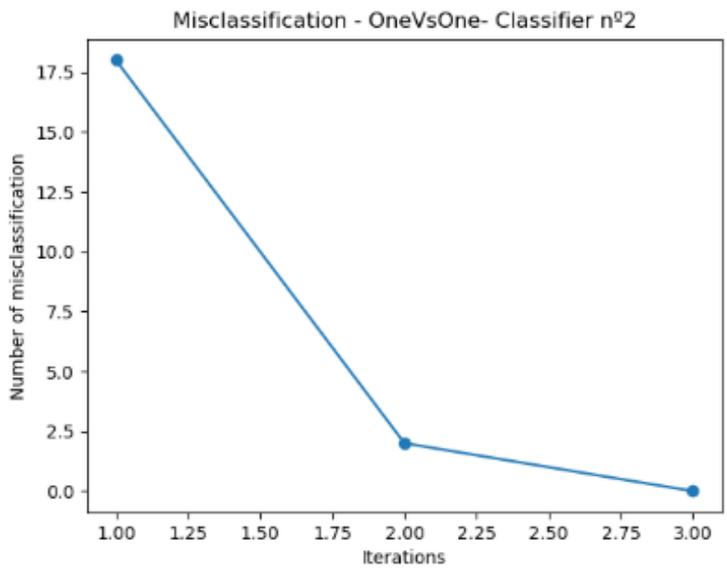

Figura 219: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

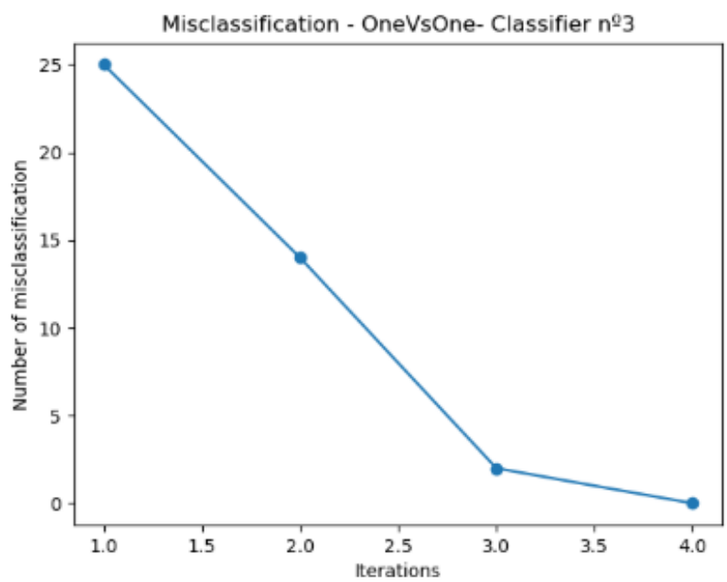

Figura 220: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

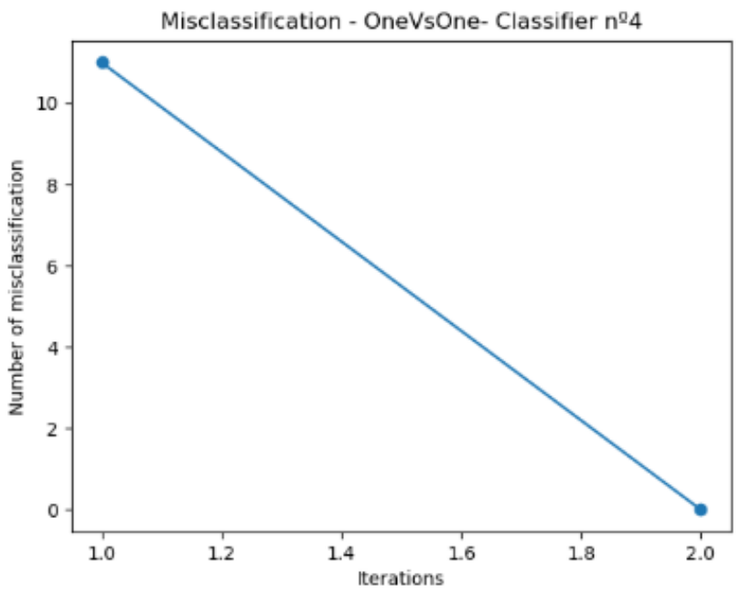

Figura 221: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

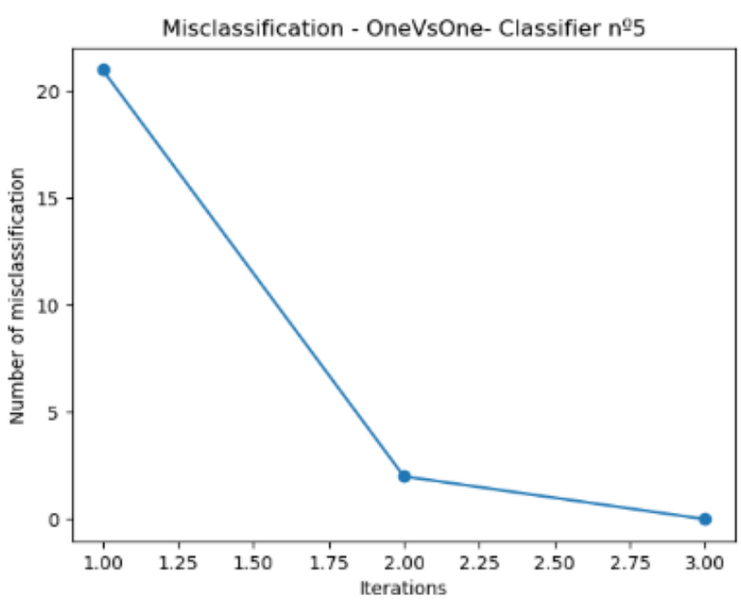

Figura 222: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

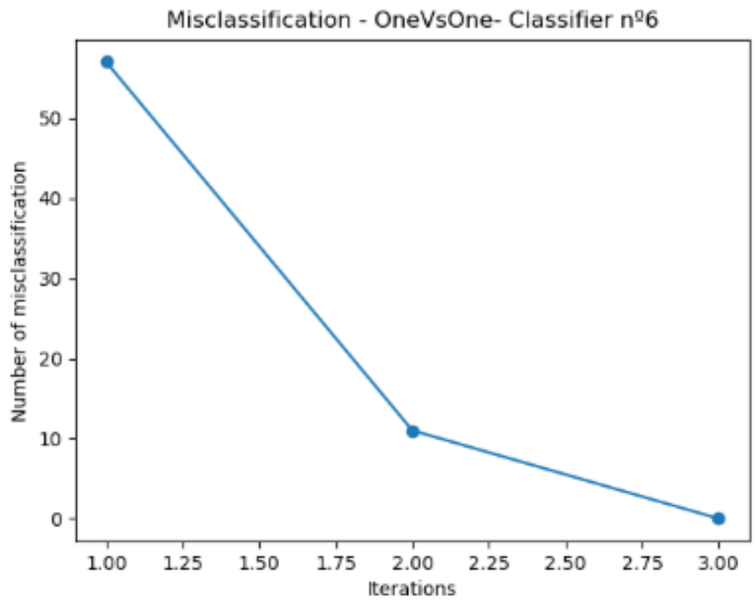

Figura 223: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

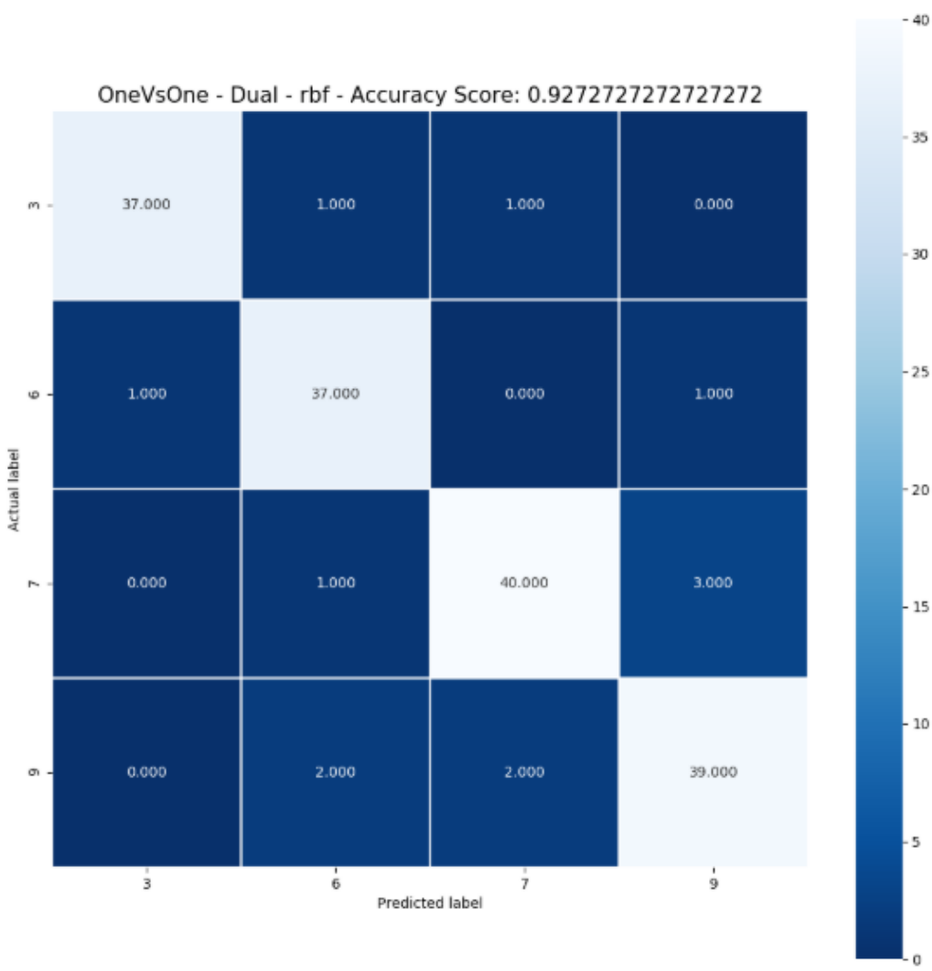

Figura 224: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

3.9 *Perceptron* Dual com *Kernel RBF* com *ECOC*

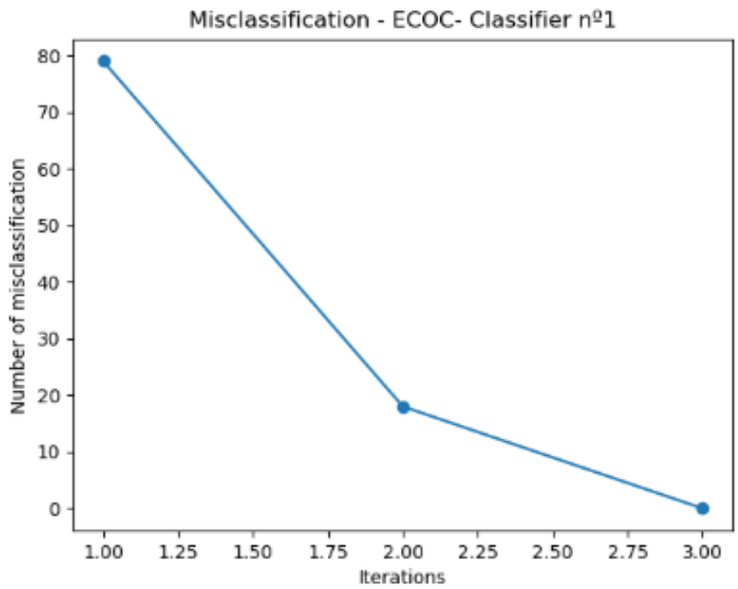

Figura 225: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

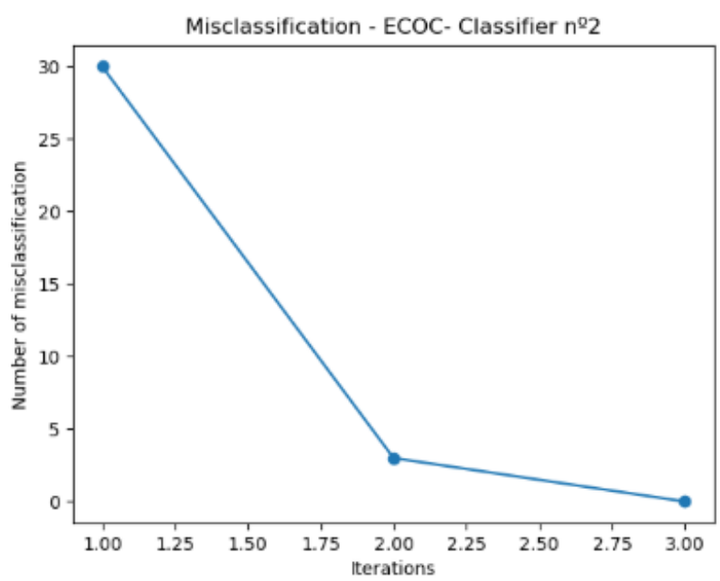

Figura 226: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

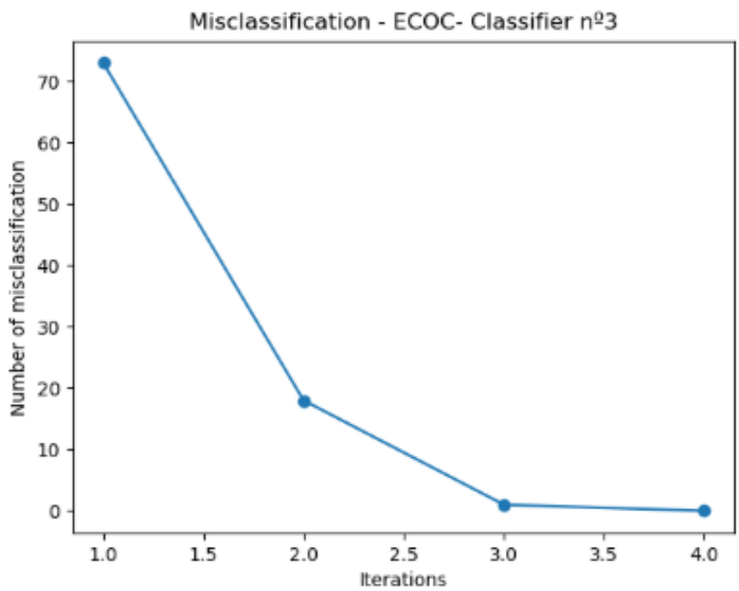

Figura 227: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

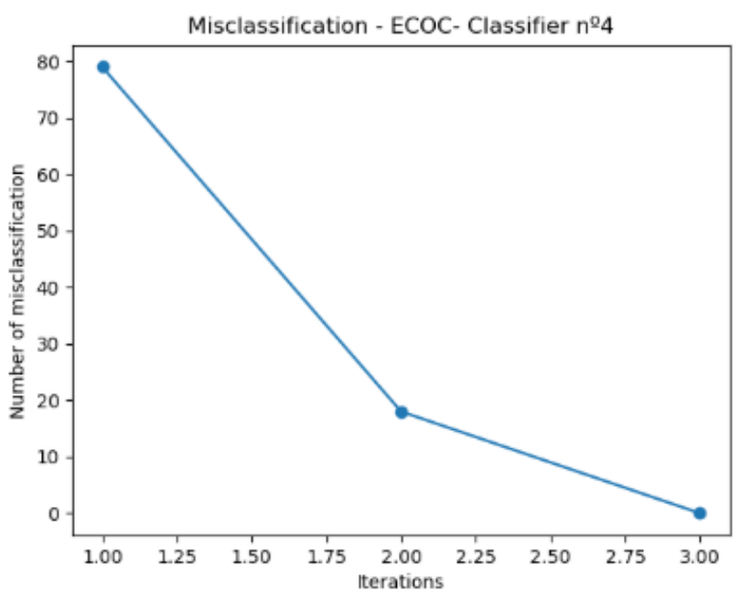

Figura 228: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

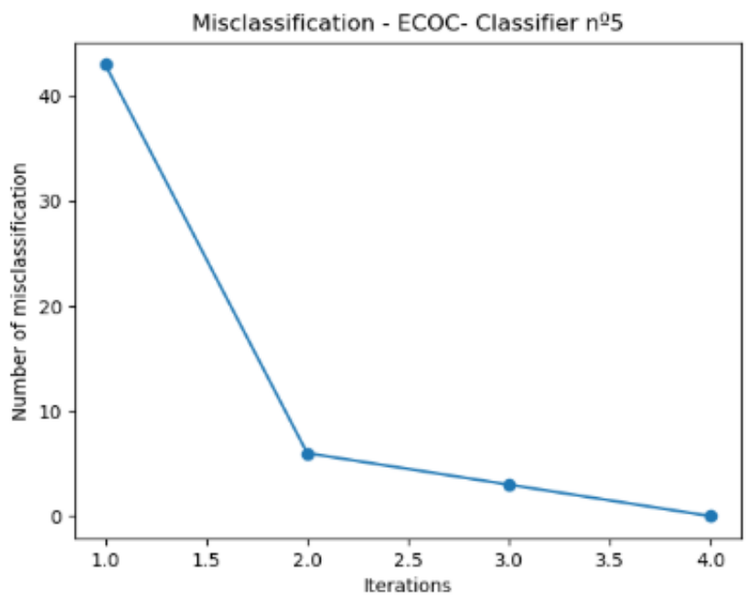

Figura 229: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

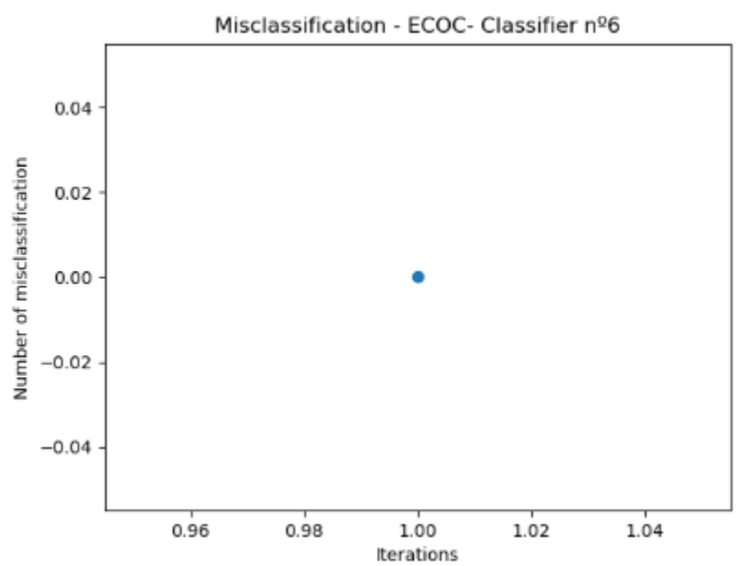

Figura 230: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

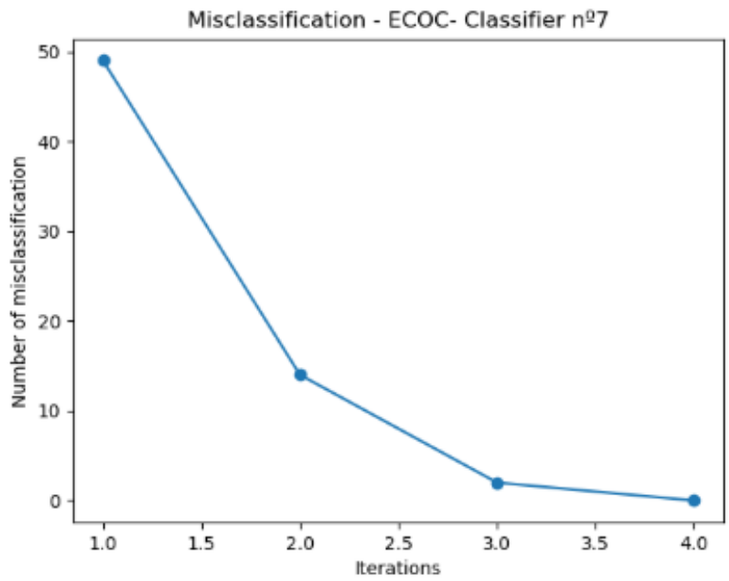

Figura 231: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

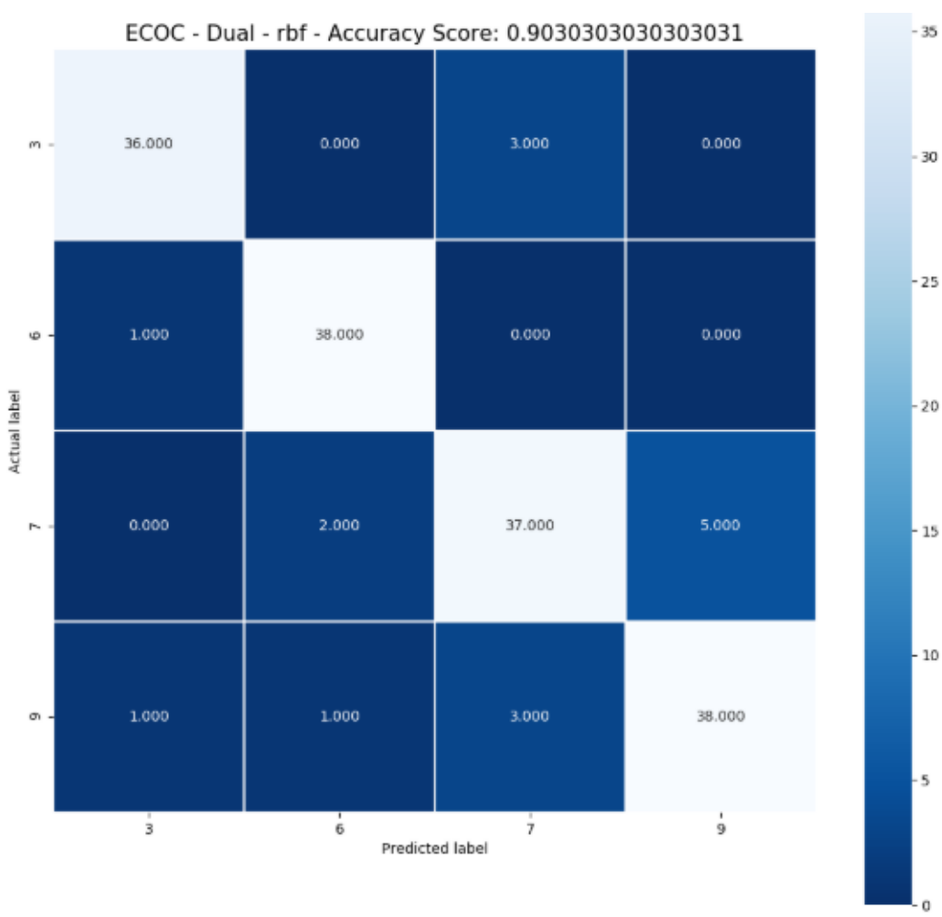

Figura 232: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

3.10 *Perceptron* Dual com *Kernel* Polinomial com *OVA*

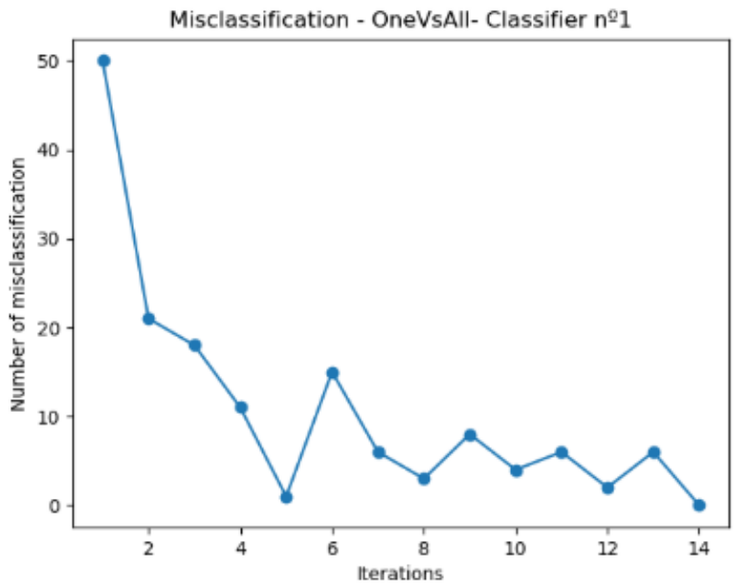

Figura 233: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

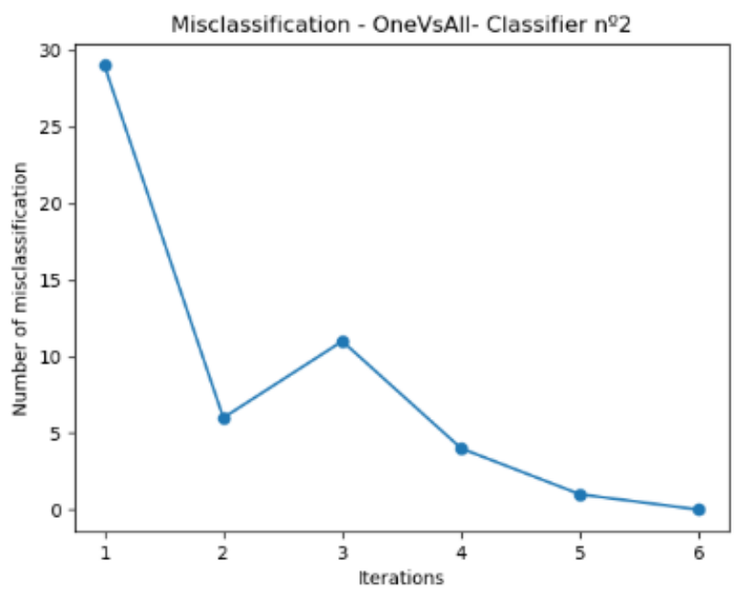

Figura 234: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

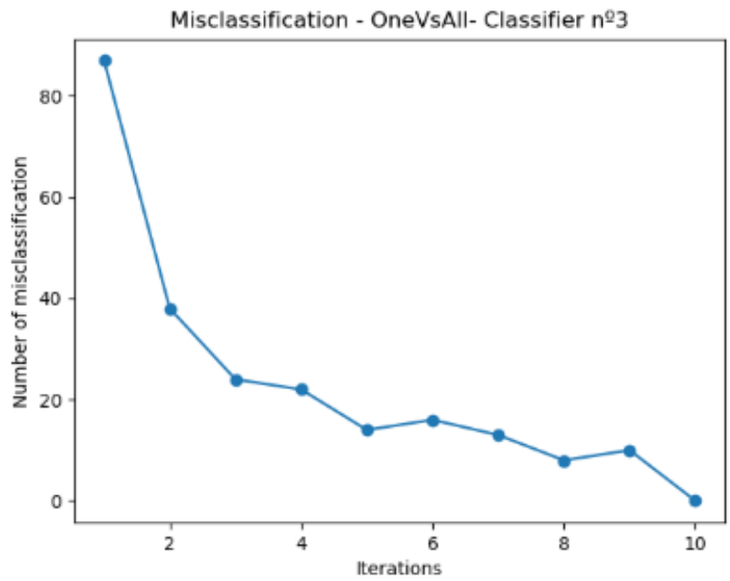

Figura 235: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

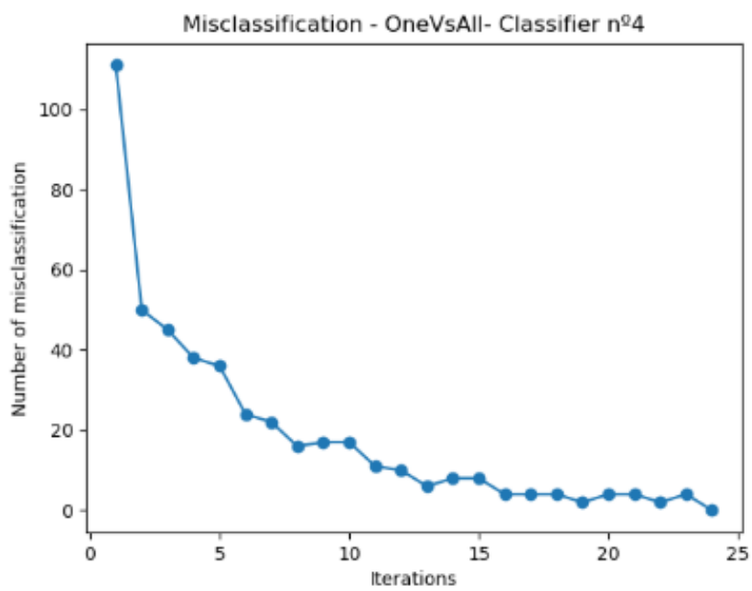

Figura 236: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

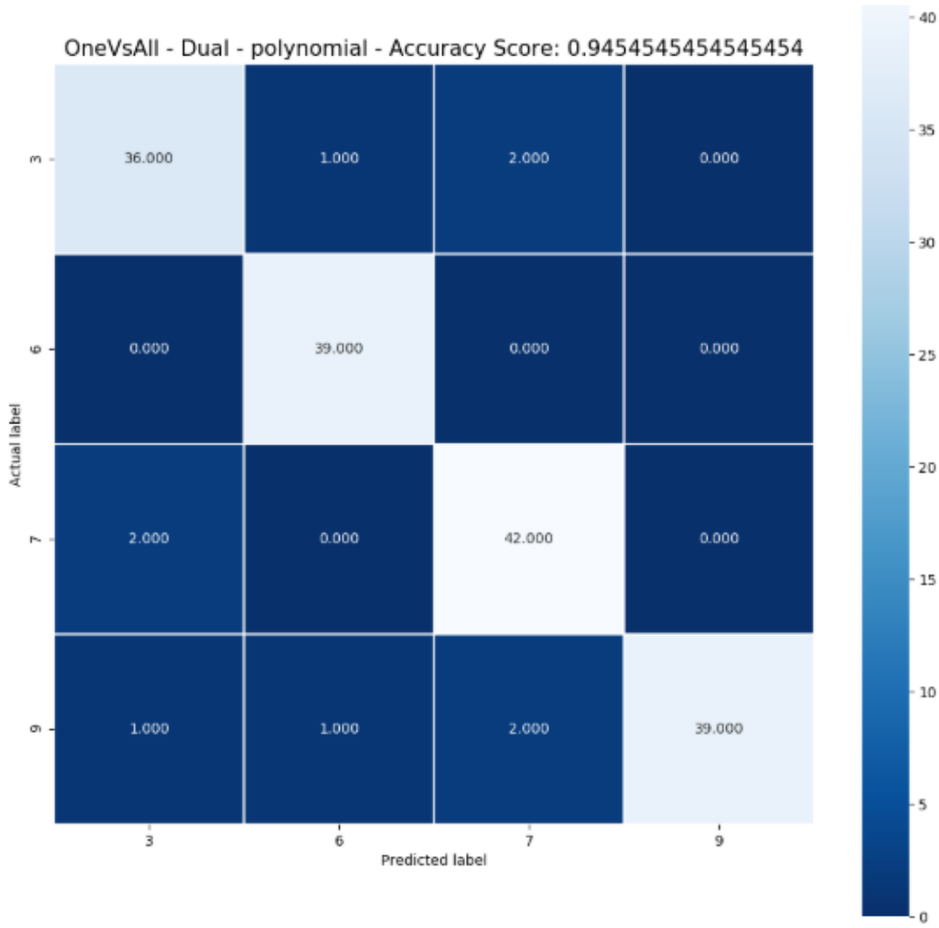

Figura 237: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

3.11 *Perceptron* Dual com *Kernel* Polinomial com *OVO*

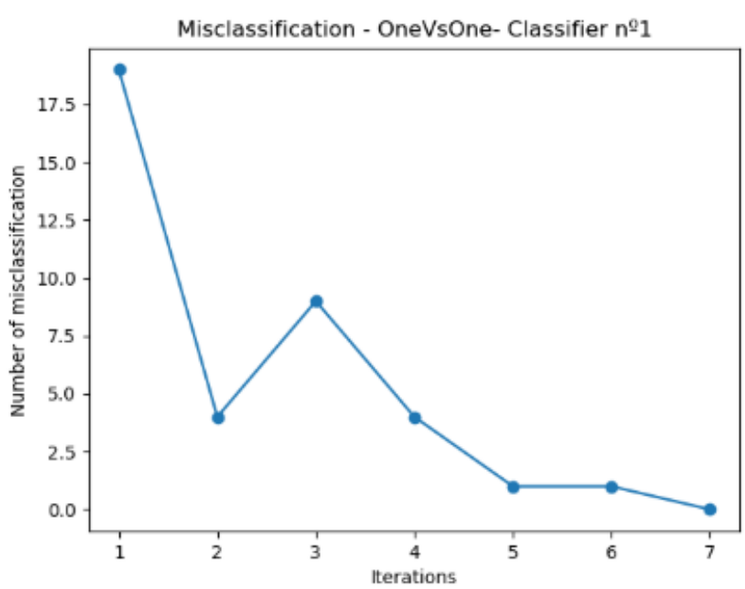

Figura 238: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

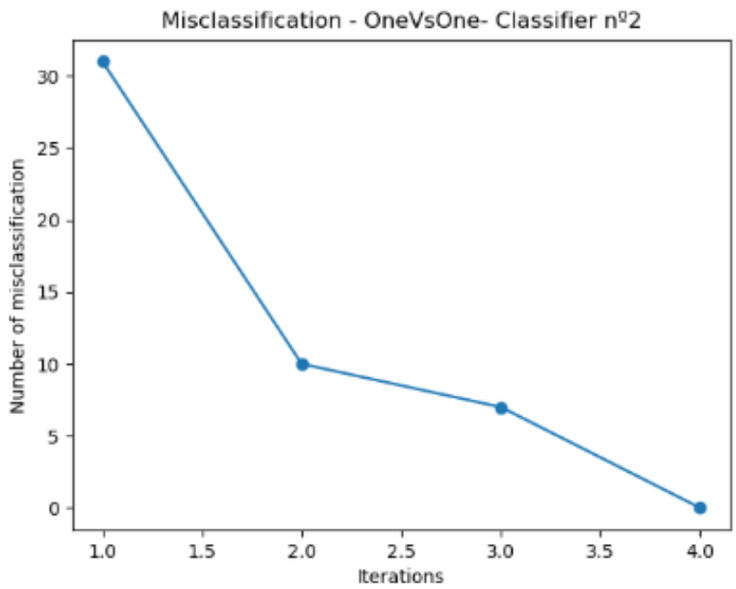

Figura 239: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

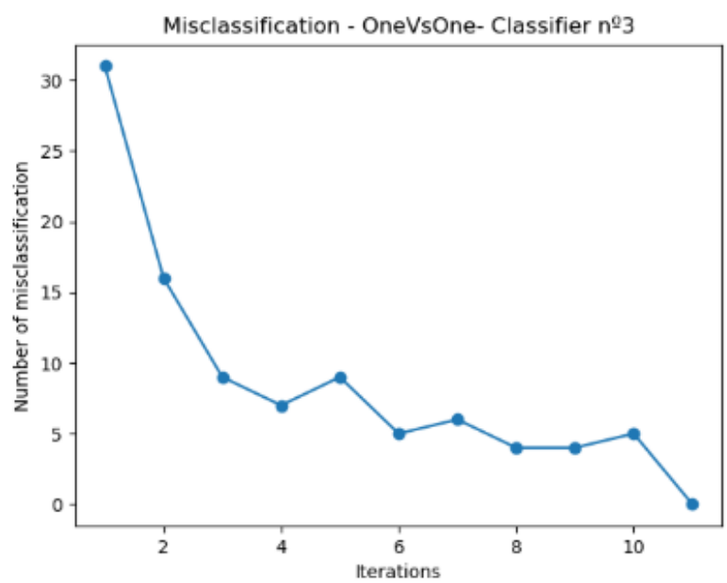

Figura 240: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

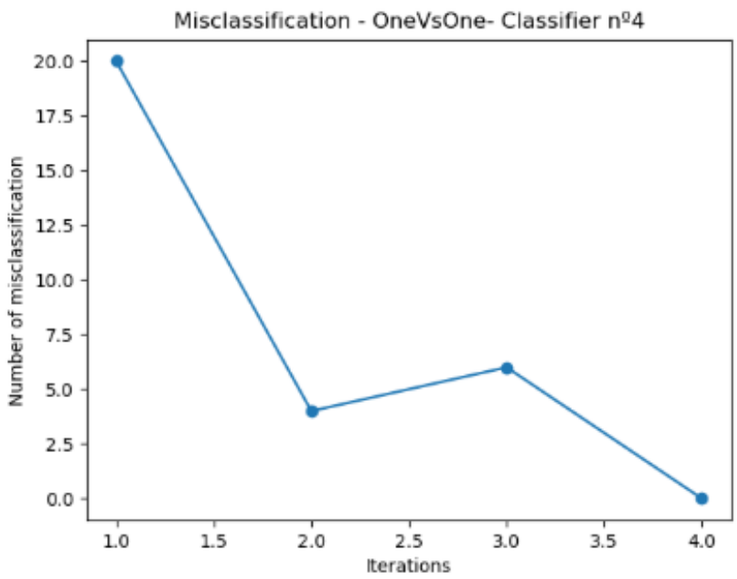

Figura 241: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

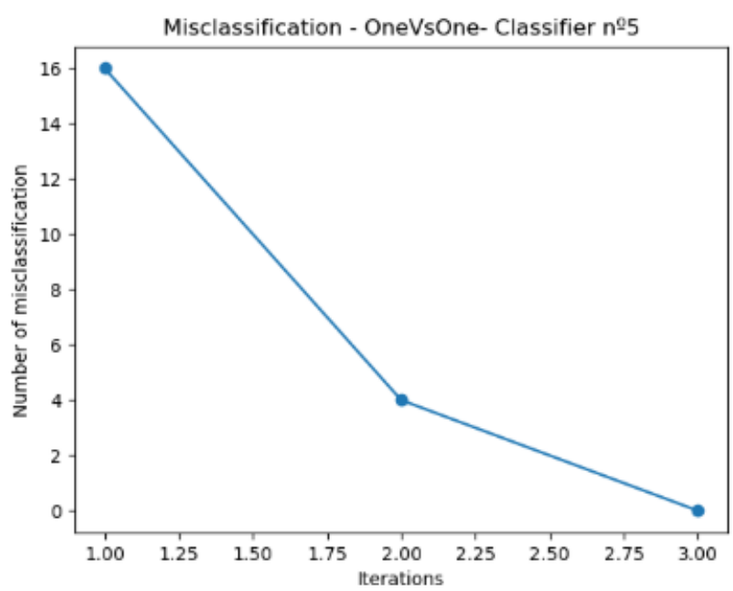

Figura 242: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

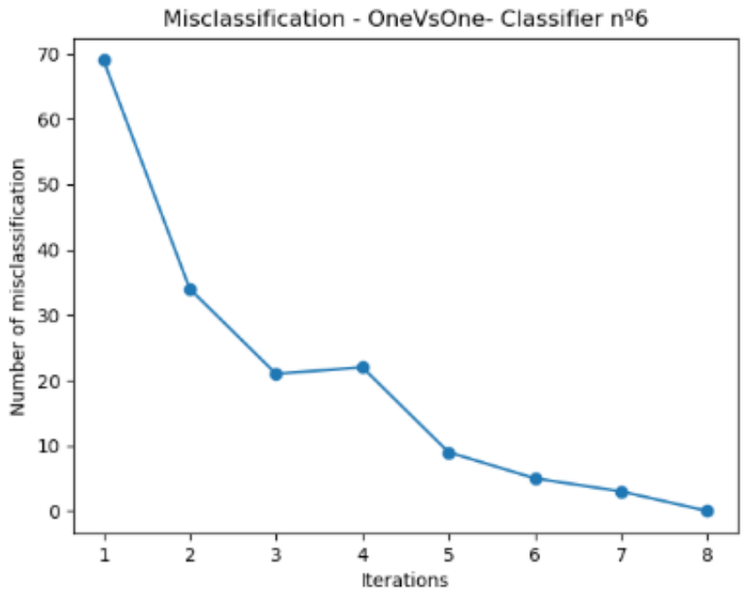

Figura 243: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

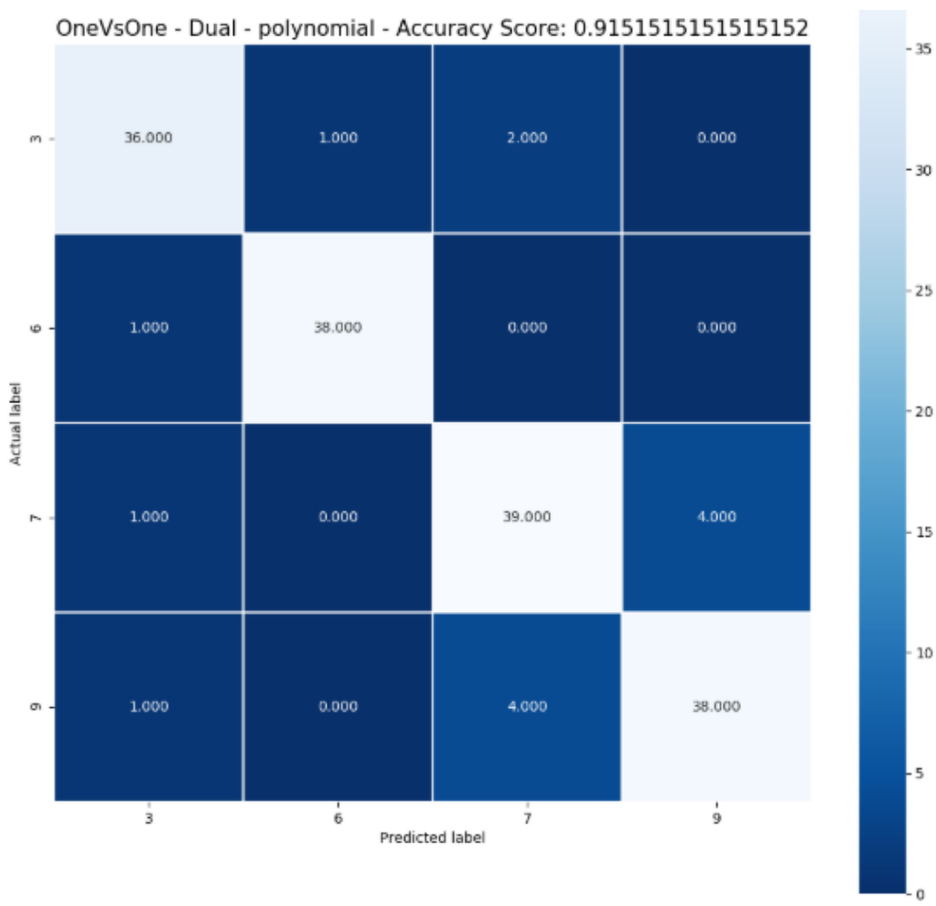

Figura 244: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

3.12 *Perceptron* Dual com *Kernel* Polinomial com *ECOC*

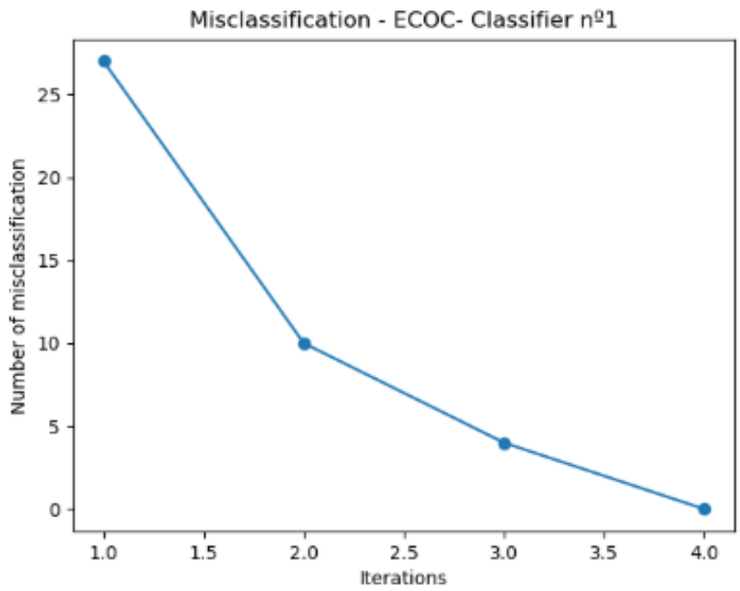

Figura 245: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

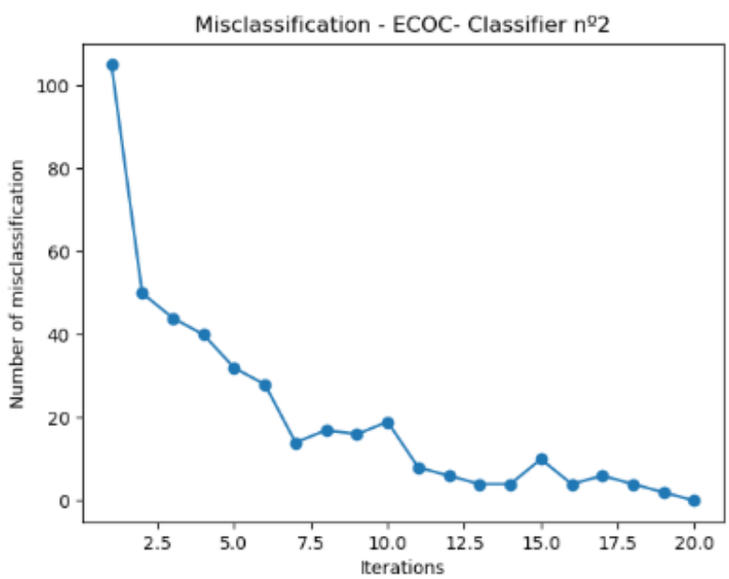

Figura 246: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

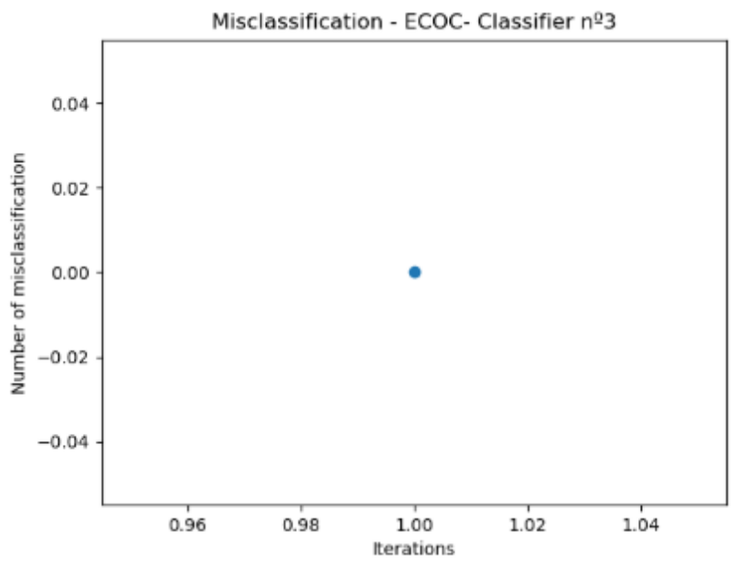

Figura 247: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

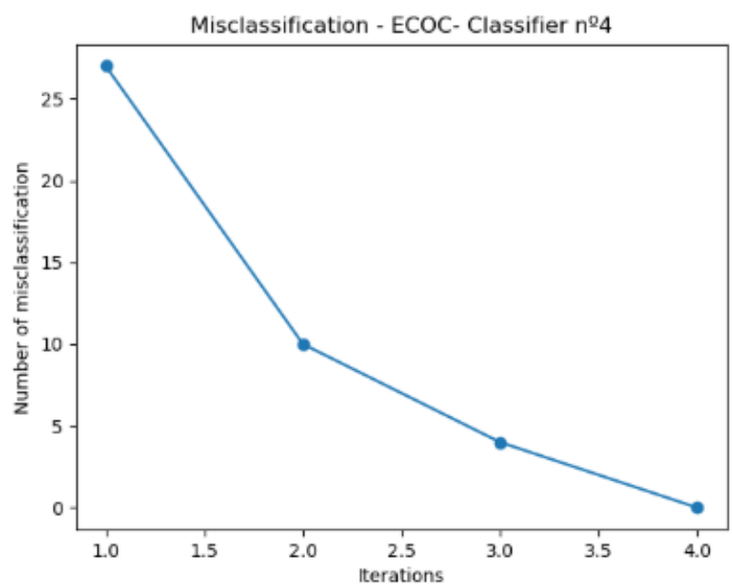

Figura 248: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

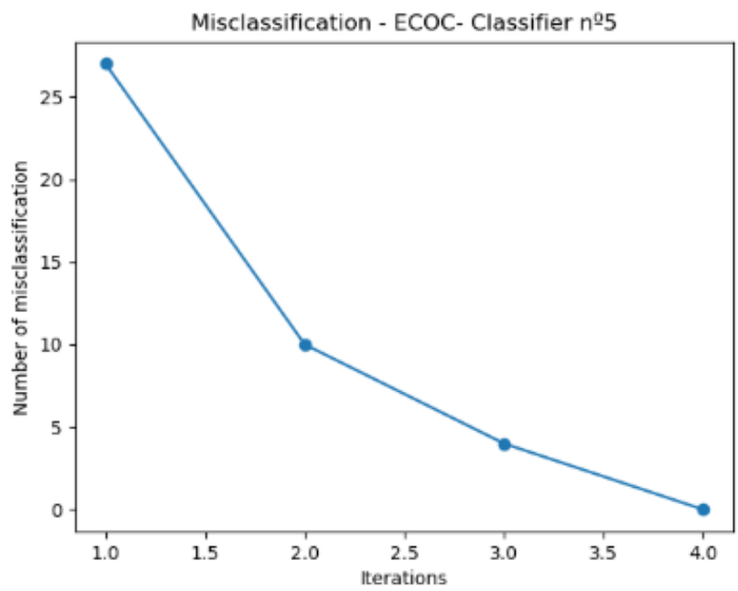

Figura 249: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

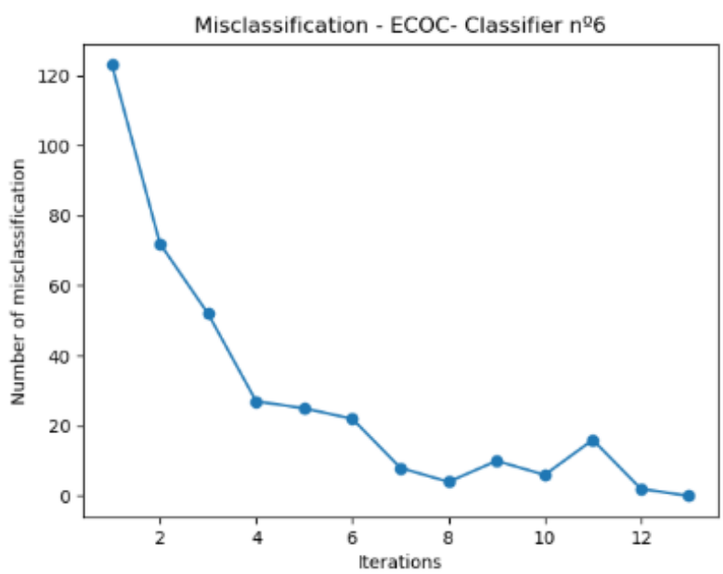

Figura 250: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

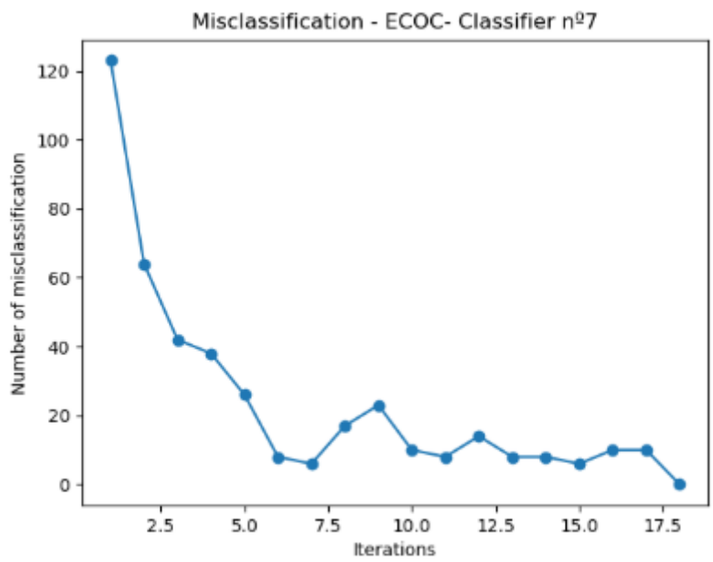

Figura 251: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

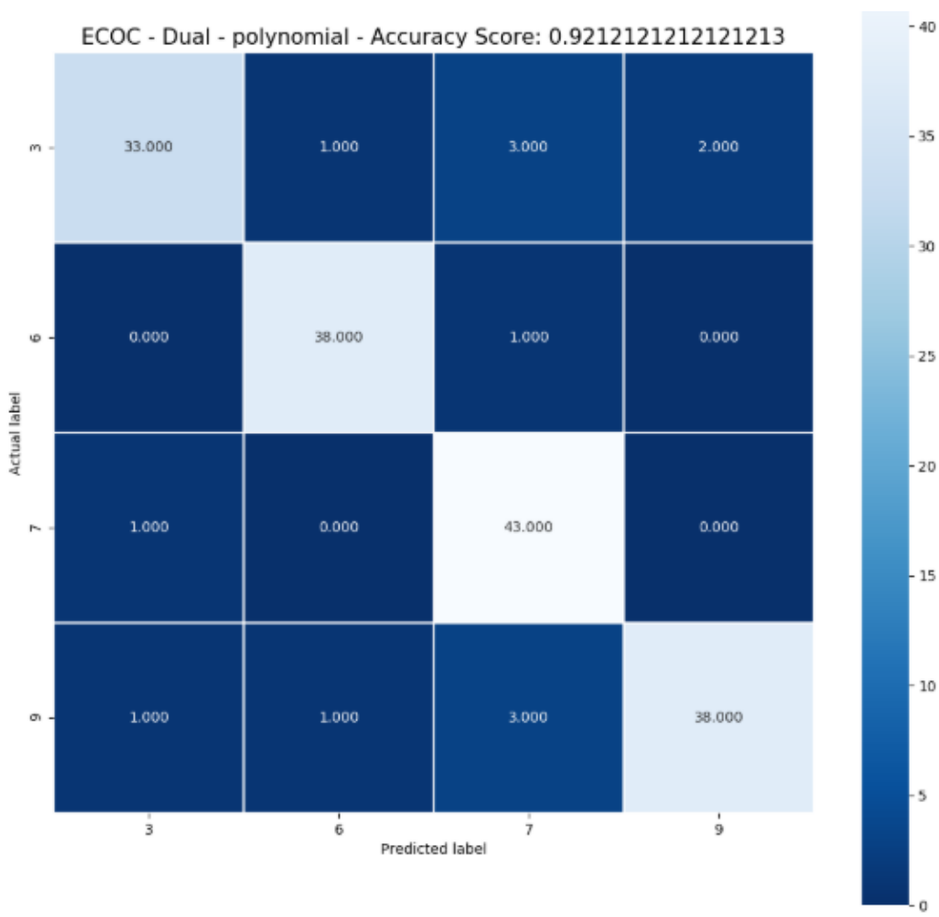

Figura 252: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

4 Resultados com *Dataset Digits* para as classes 3679

4.1 *Perceptron* Primal com *OVA*

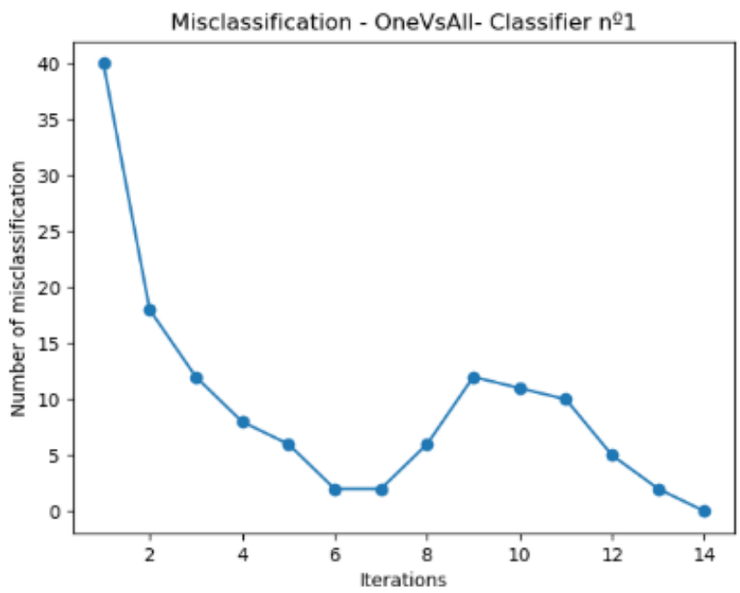

Figura 253: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

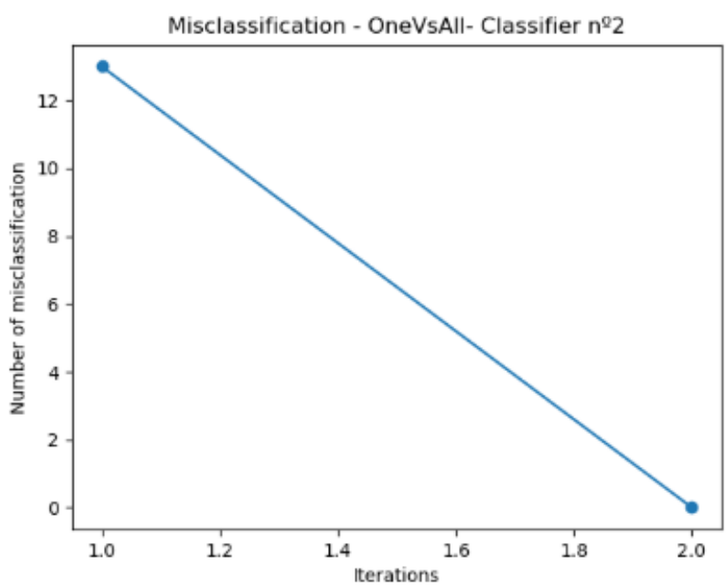

Figura 254: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

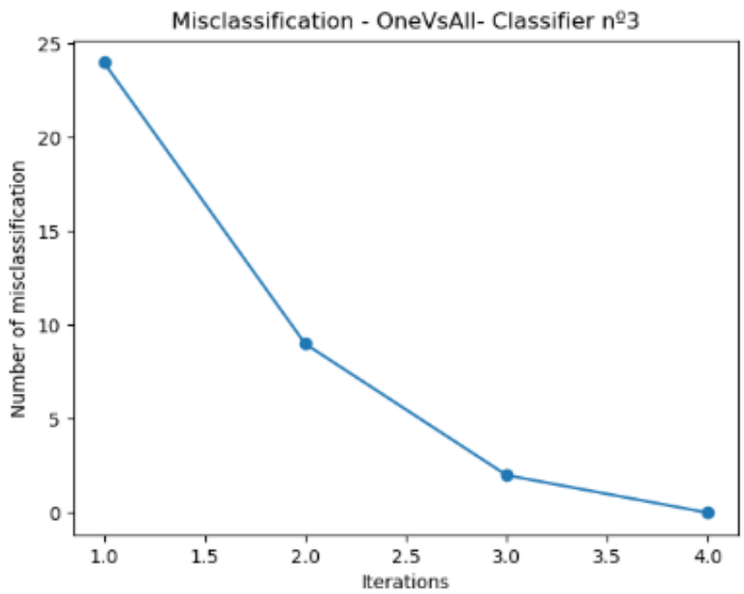

Figura 255: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

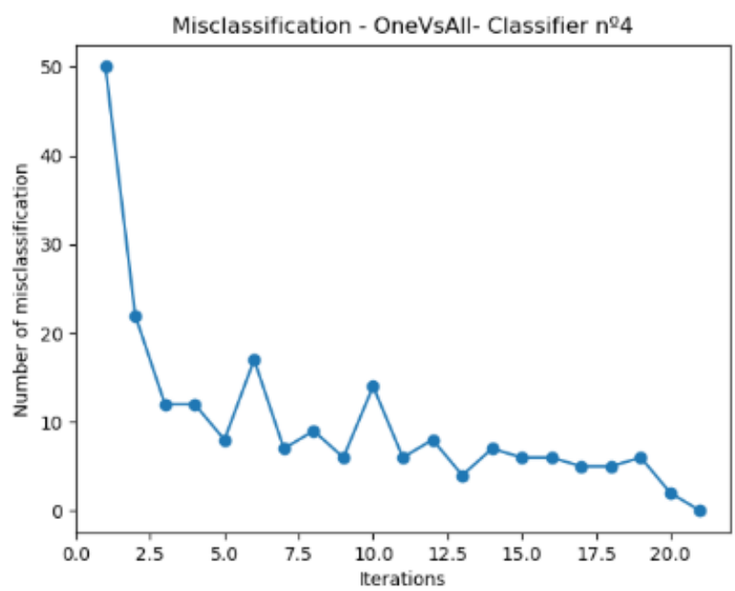

Figura 256: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

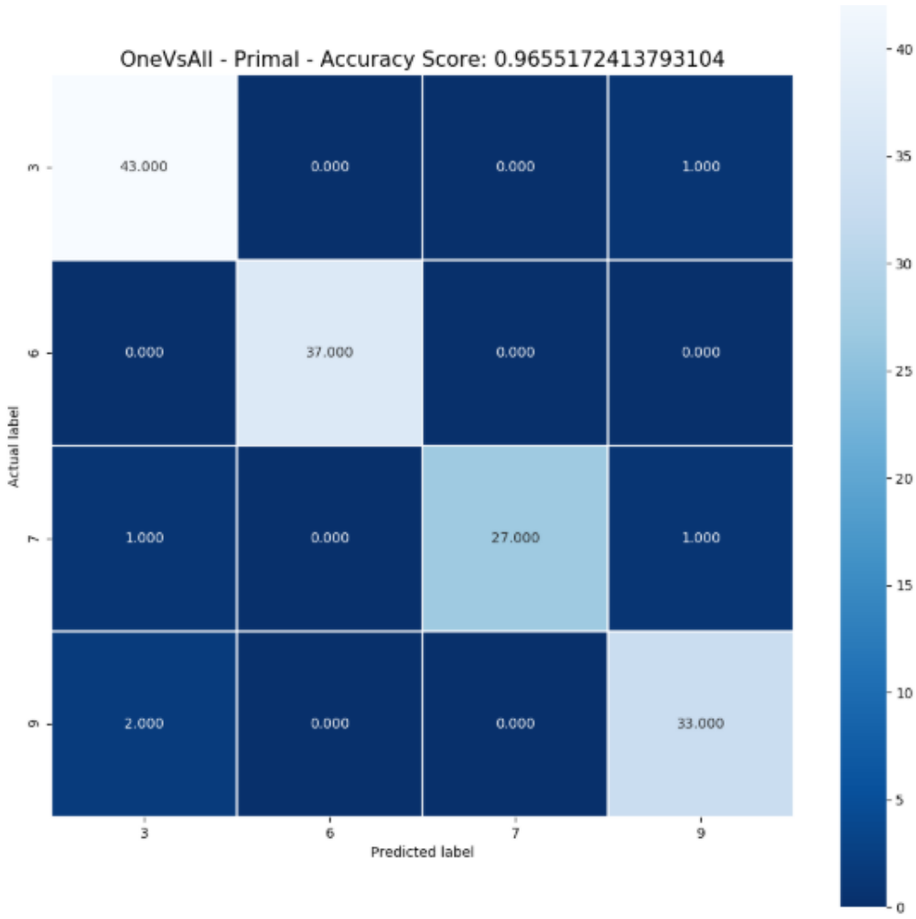

Figura 257: *OneVsAll — Accuracy* utilizando o *Dataset Digits*

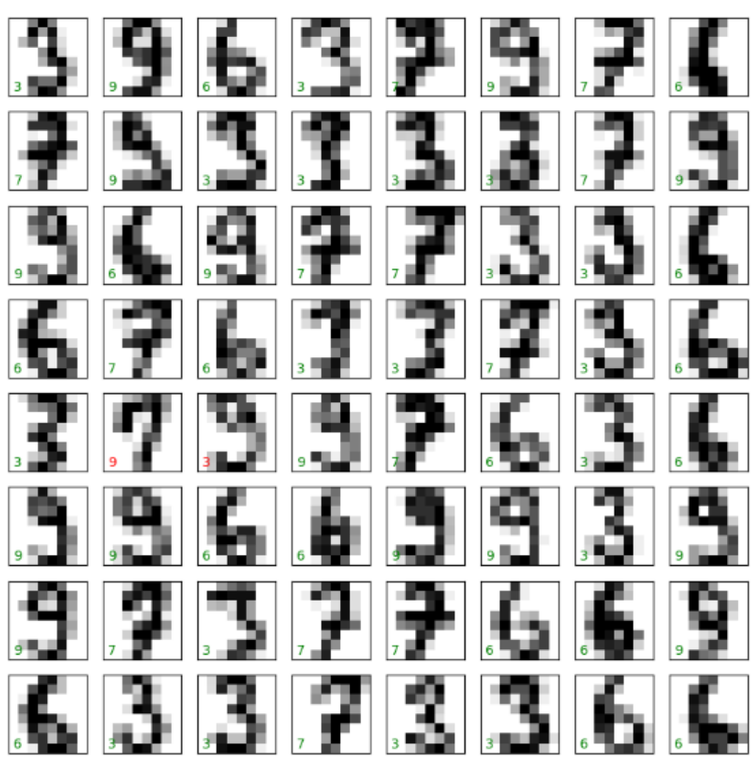

Figura 258: *OneVsAll — Predictions* utilizando o *Dataset Digits*

4.2 *Perceptron* Primal com *OVO*

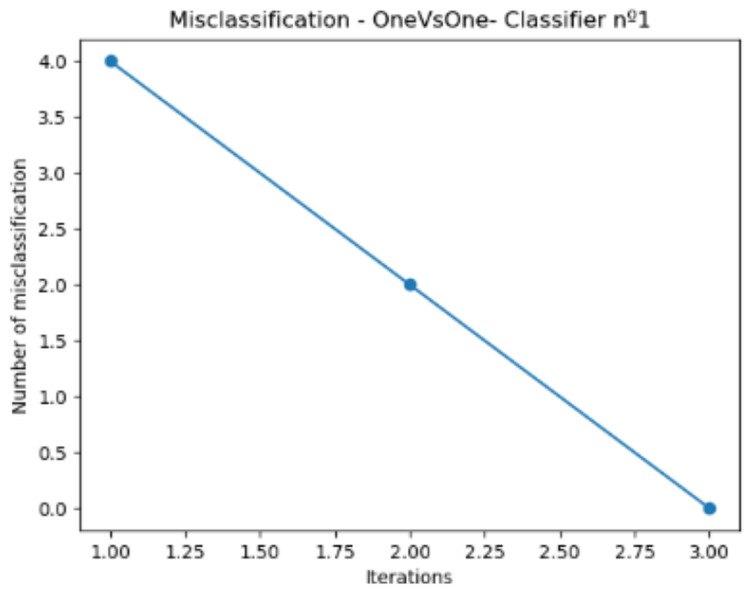

Figura 259: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

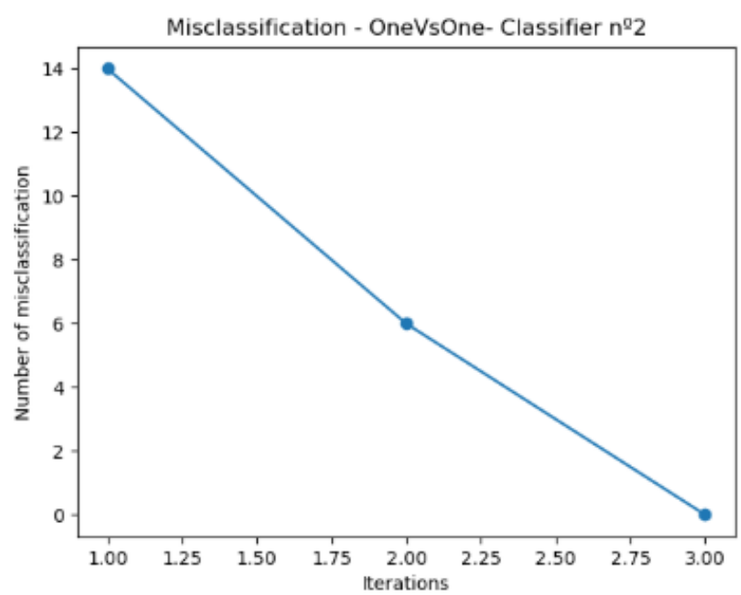

Figura 260: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

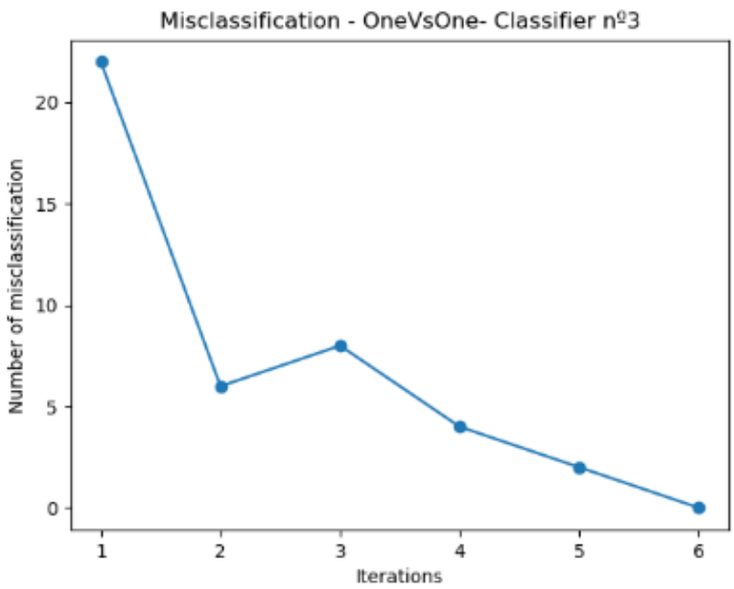

Figura 261: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

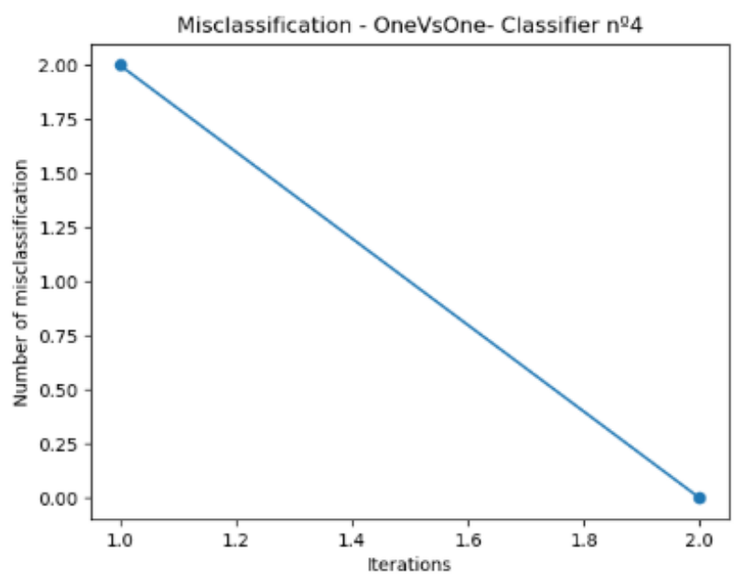

Figura 262: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

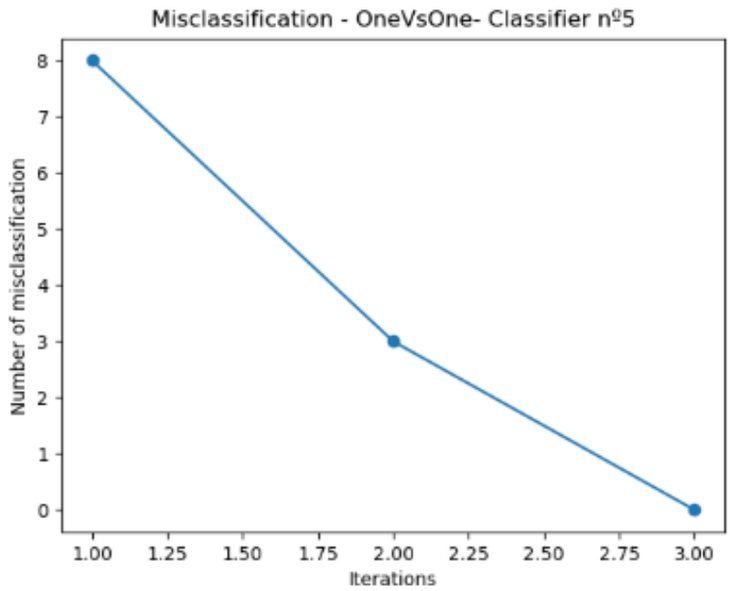

Figura 263: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

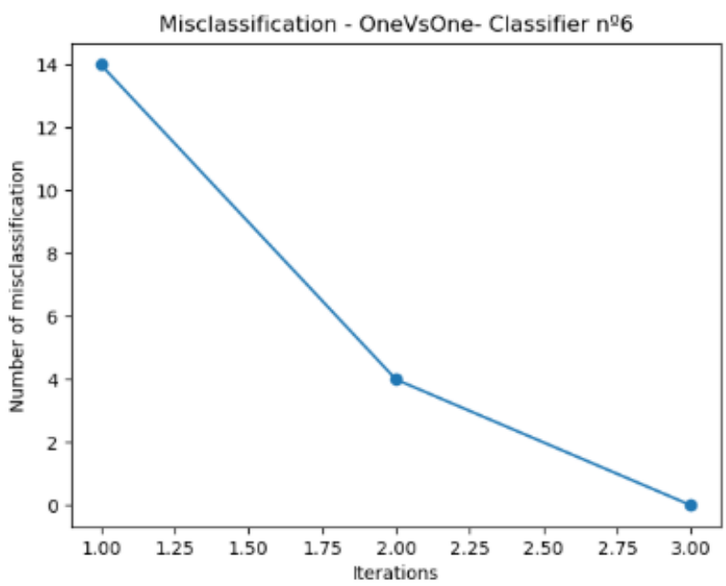

Figura 264: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

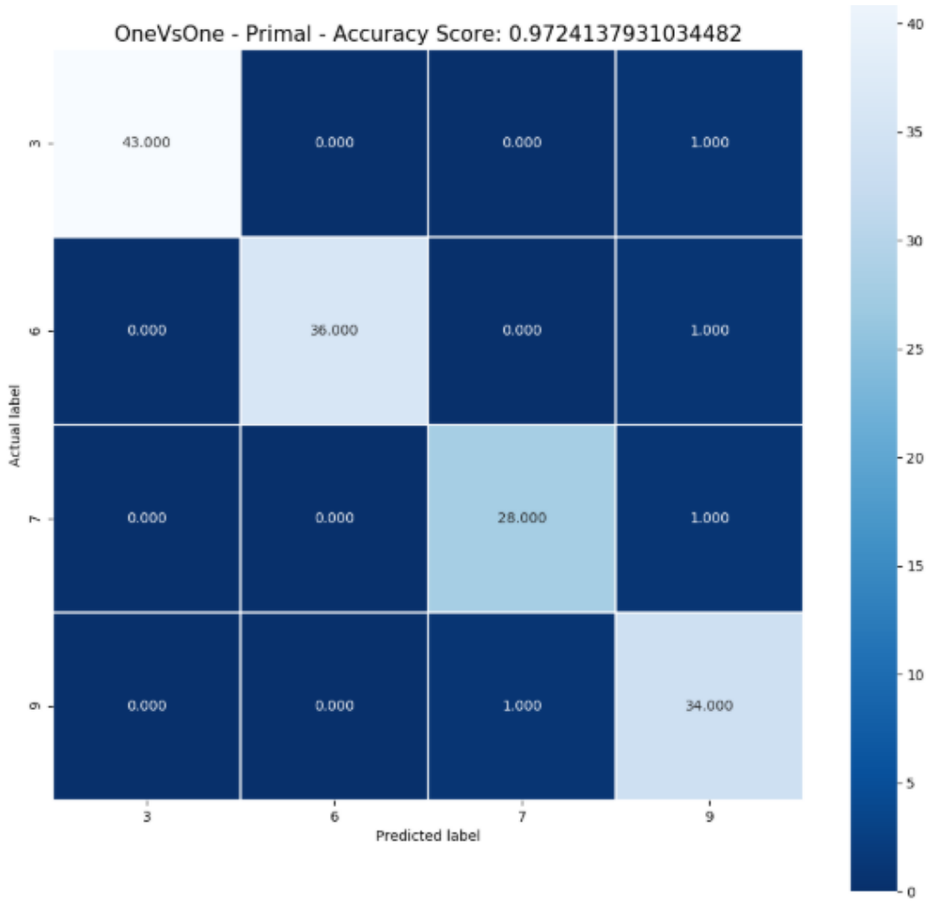

Figura 265: *OneVsOne — Accuracy* utilizando o *Dataset Digits*

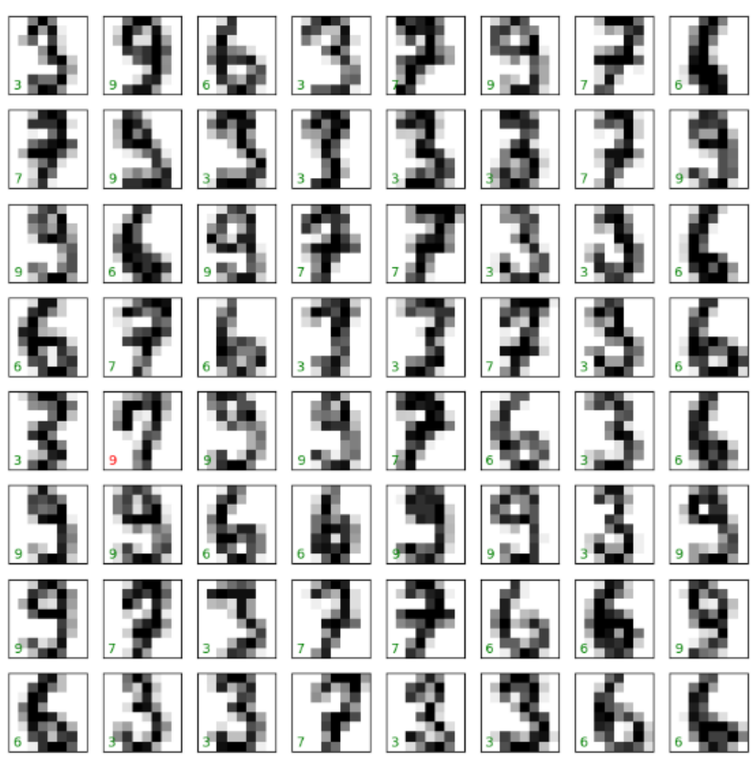

Figura 266: *OneVsOne — Predictions* utilizando o *Dataset Digits*

4.3 *Perceptron* Primal com *ECOC*

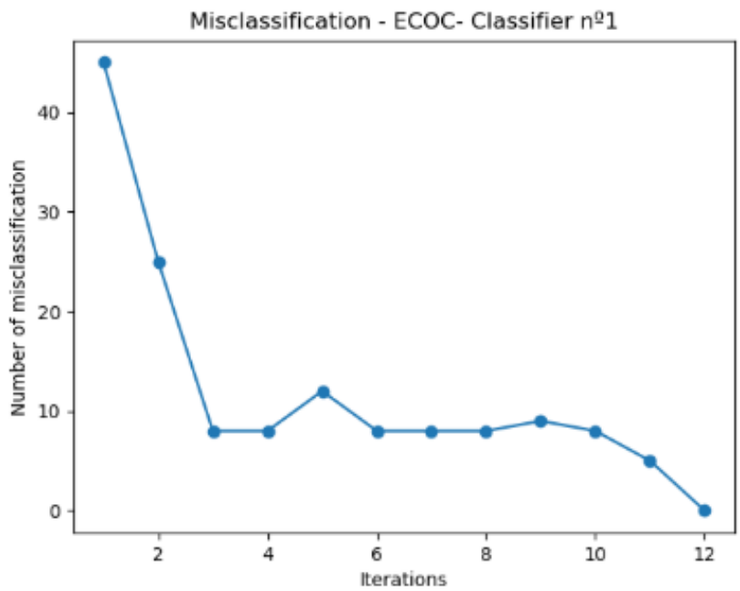

Figura 267: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

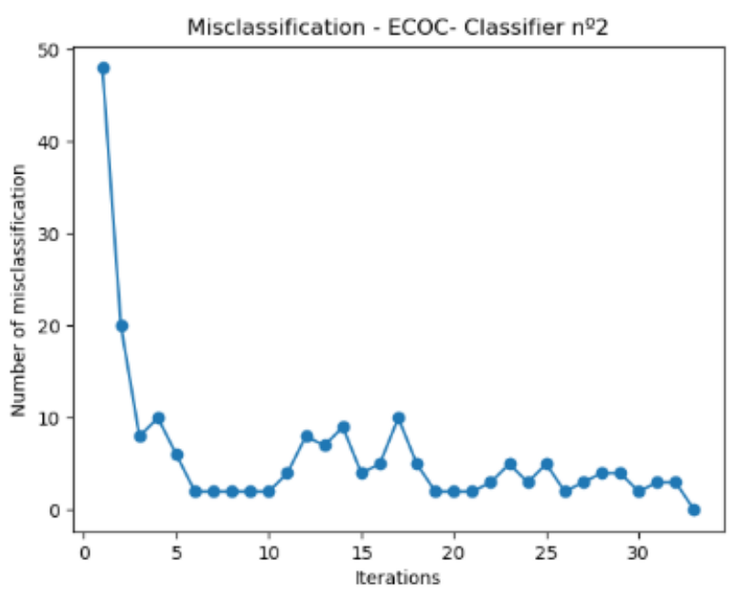

Figura 268: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

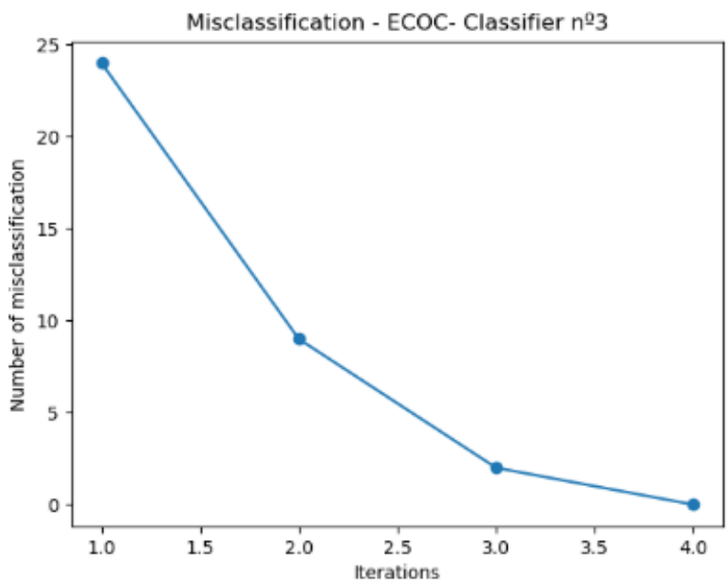

Figura 269: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

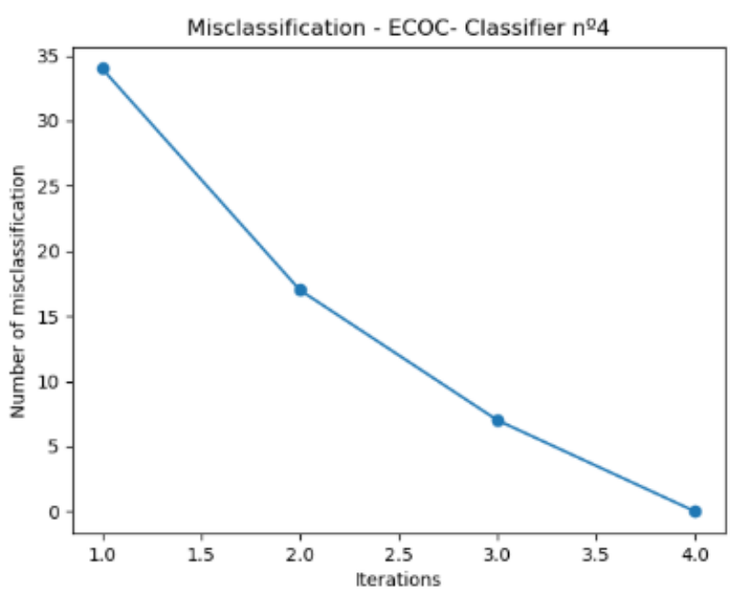

Figura 270: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

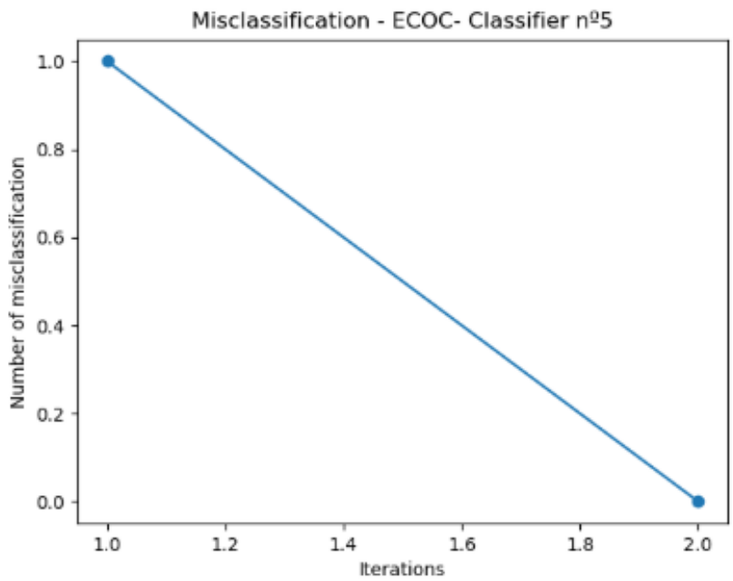

Figura 271: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

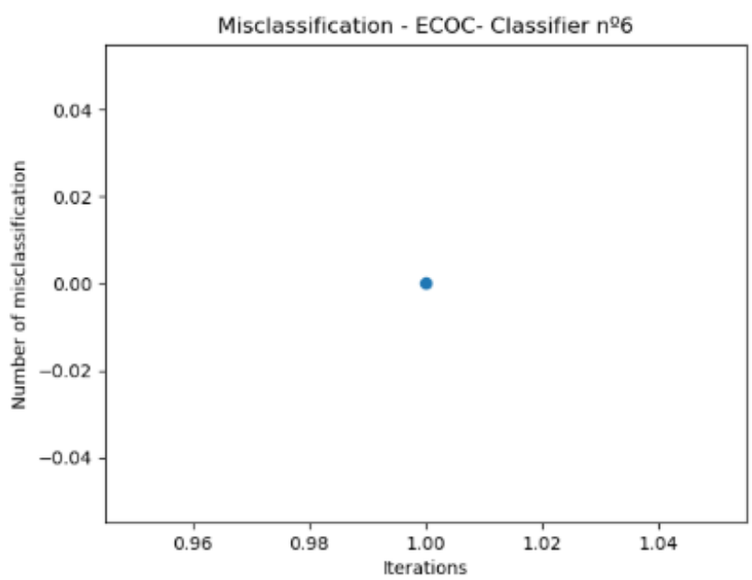

Figura 272: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

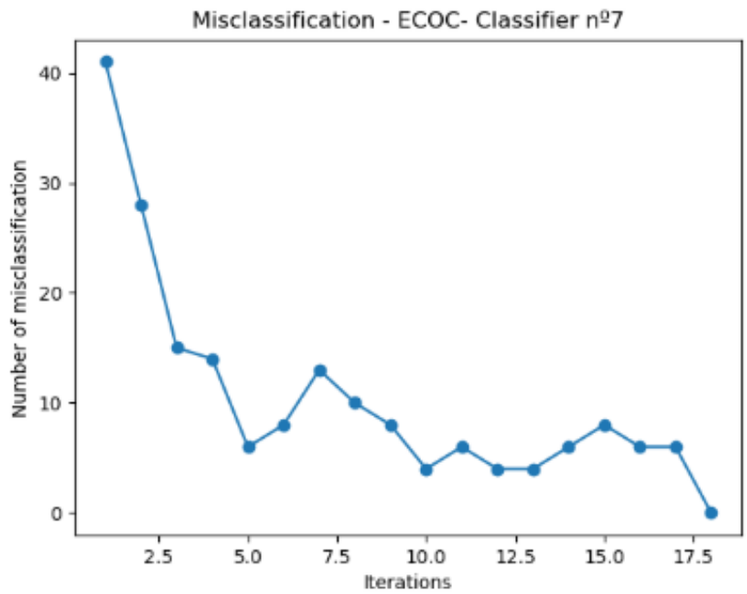

Figura 273: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

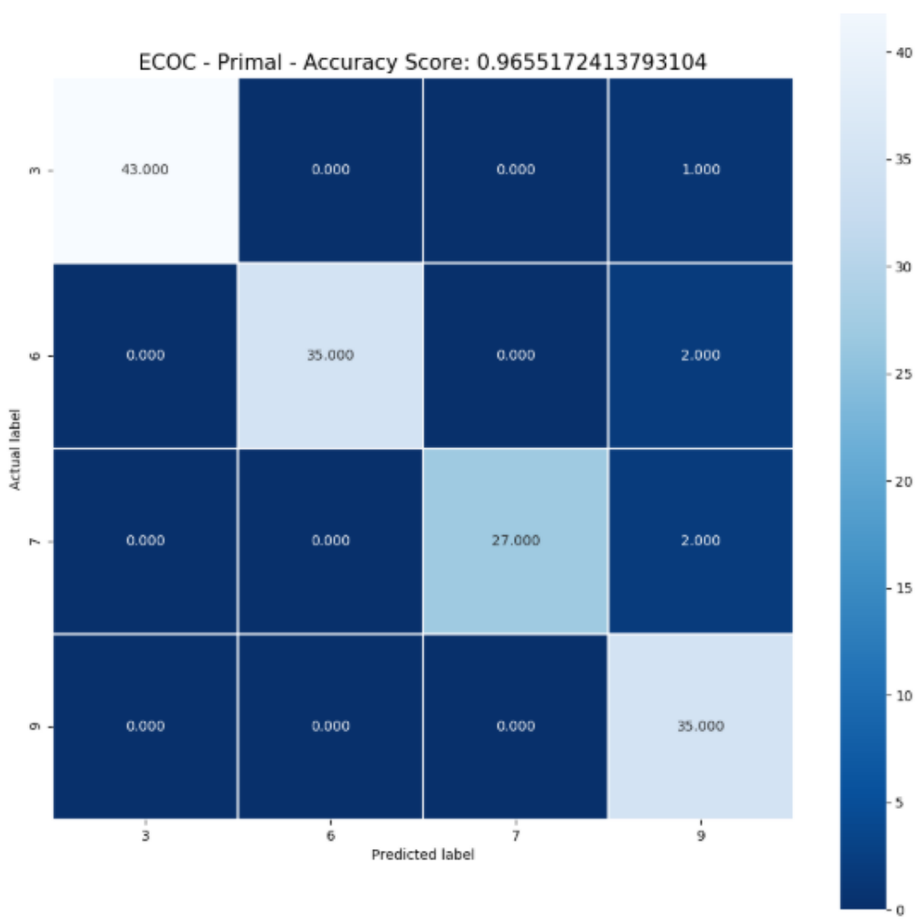

Figura 274: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

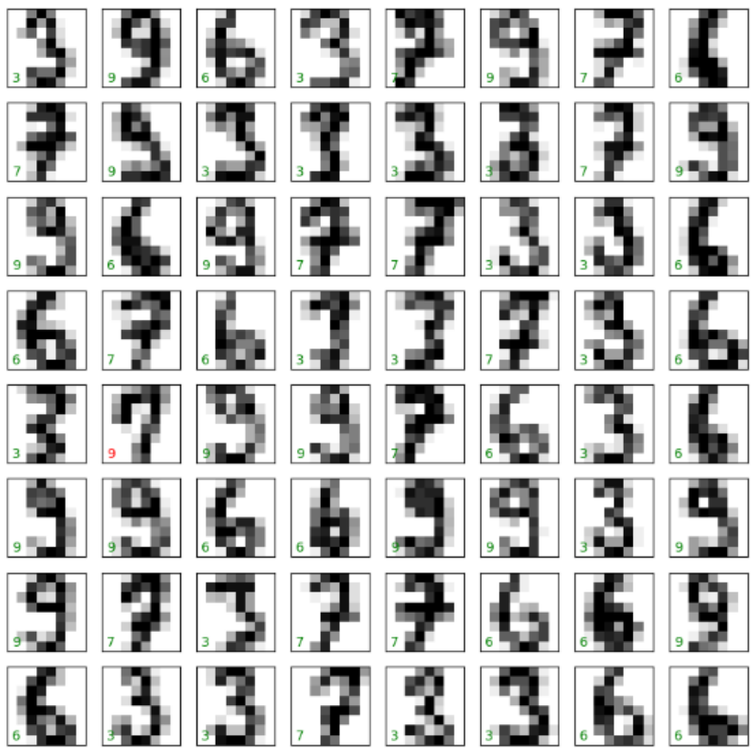

Figura 275: *ECOC* — *Predictions* utilizando o *Dataset Digits*

4.4 *Perceptron* Dual com *OVA*

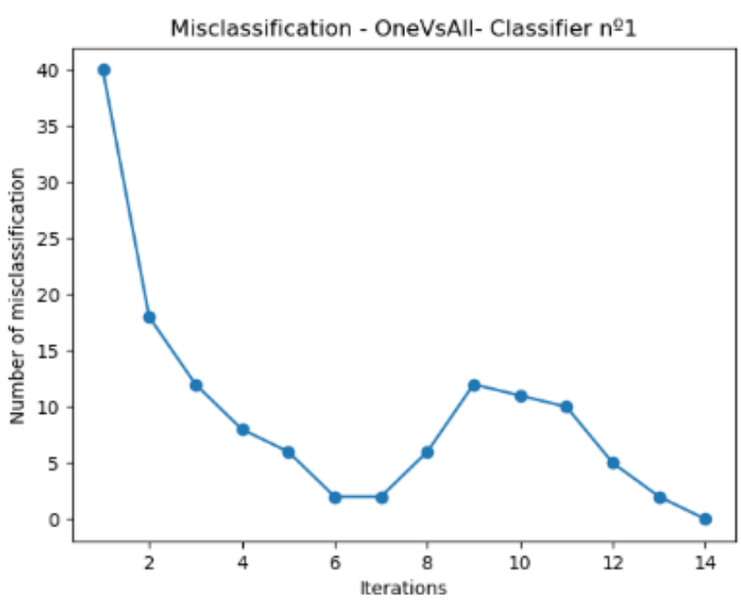

Figura 276: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

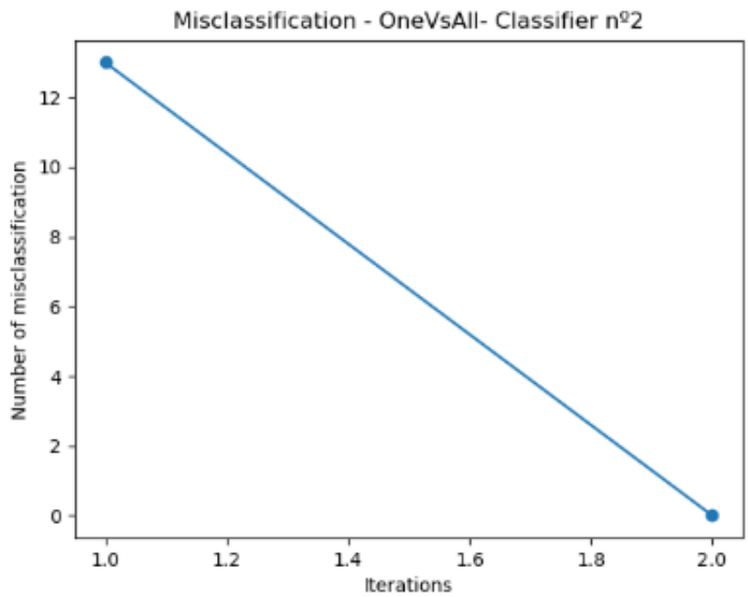

Figura 277: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

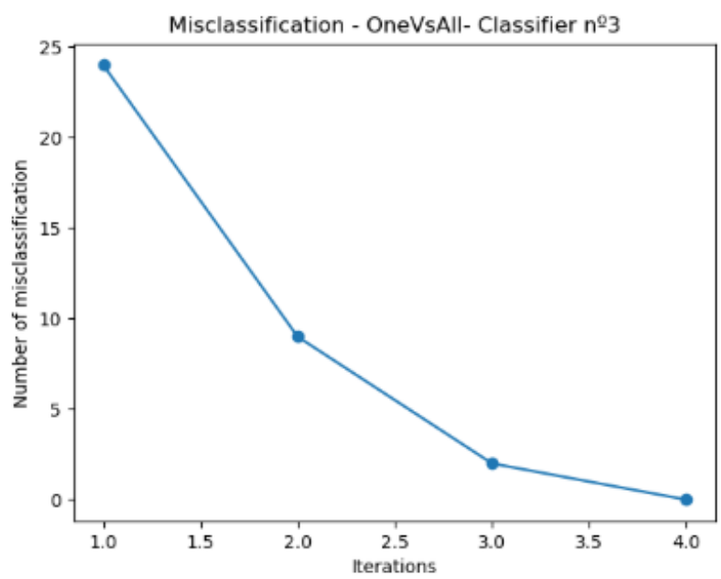

Figura 278: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

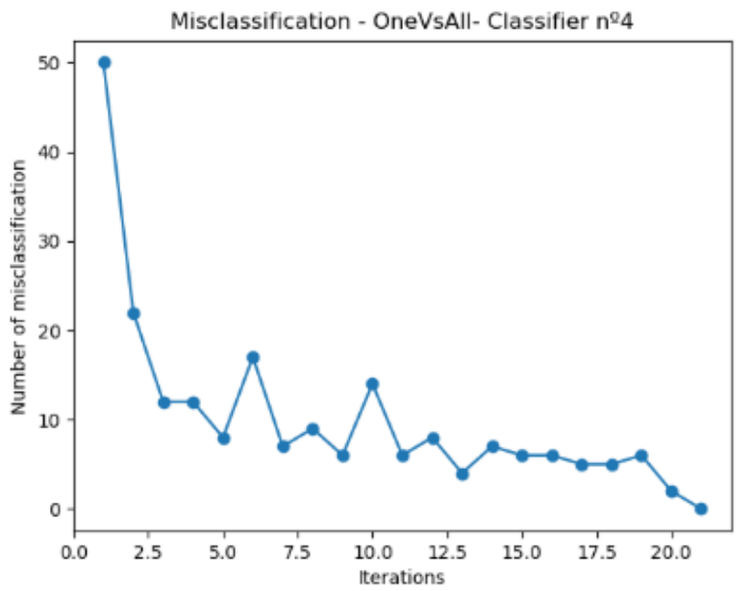

Figura 279: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

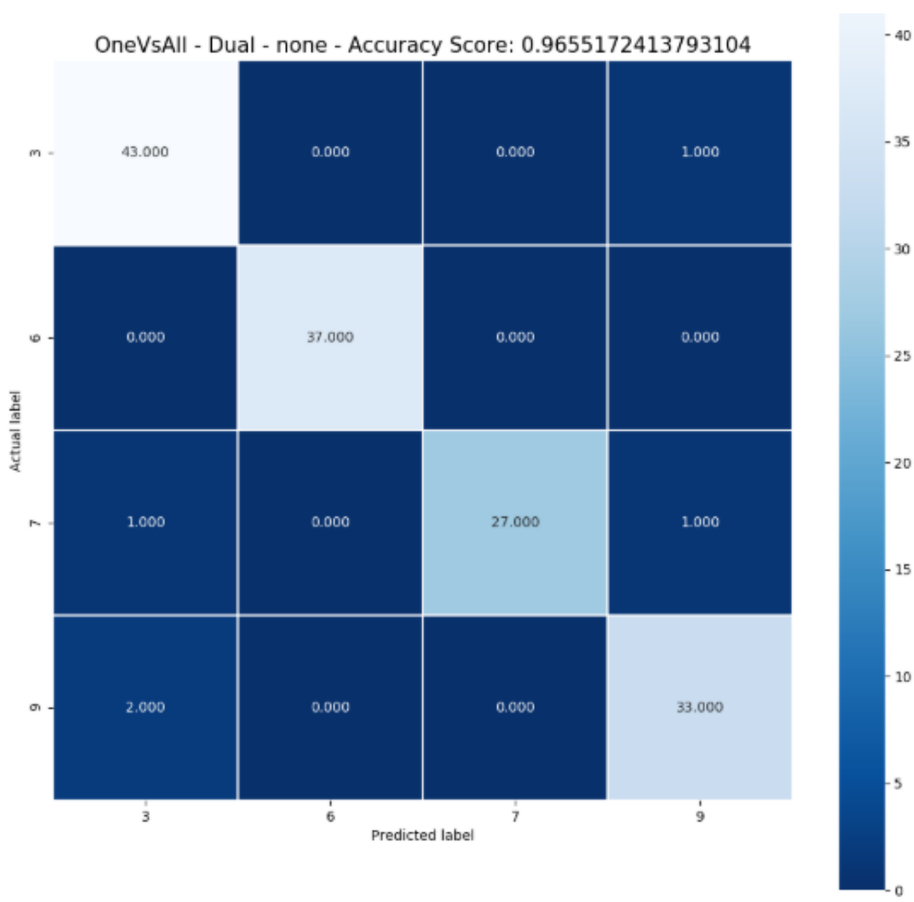

Figura 280: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

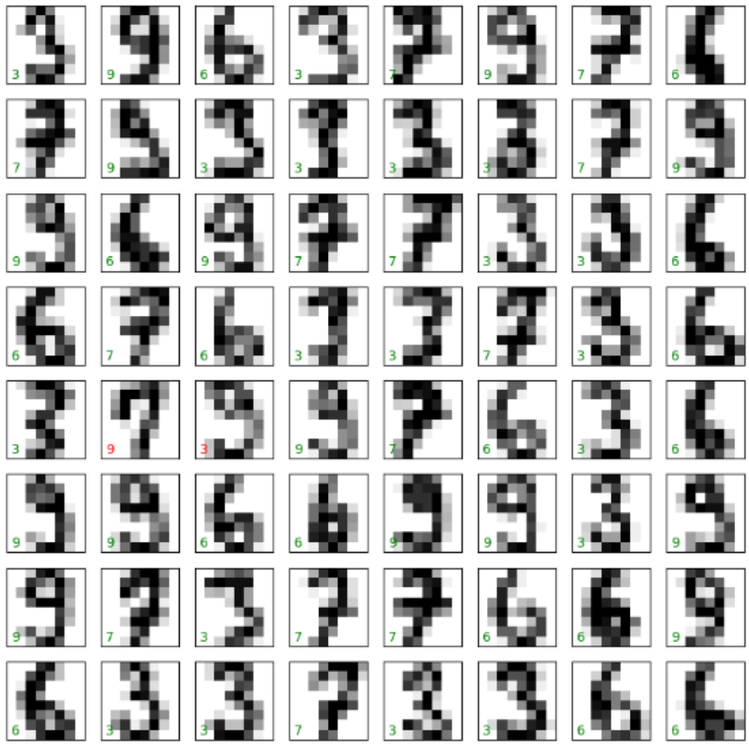

Figura 281: *OneVsAll* — *Predictions* utilizando o *Dataset Digits*

4.5 *Perceptron* Dual com *OVO*

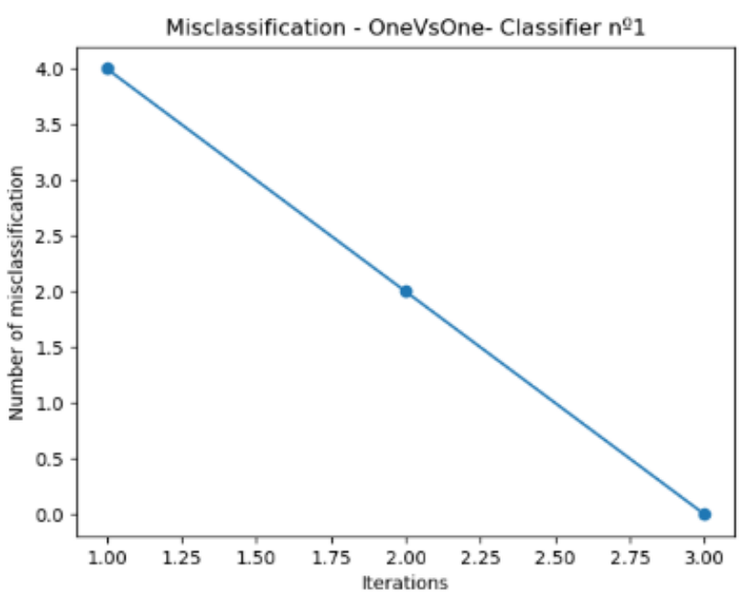

Figura 282: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

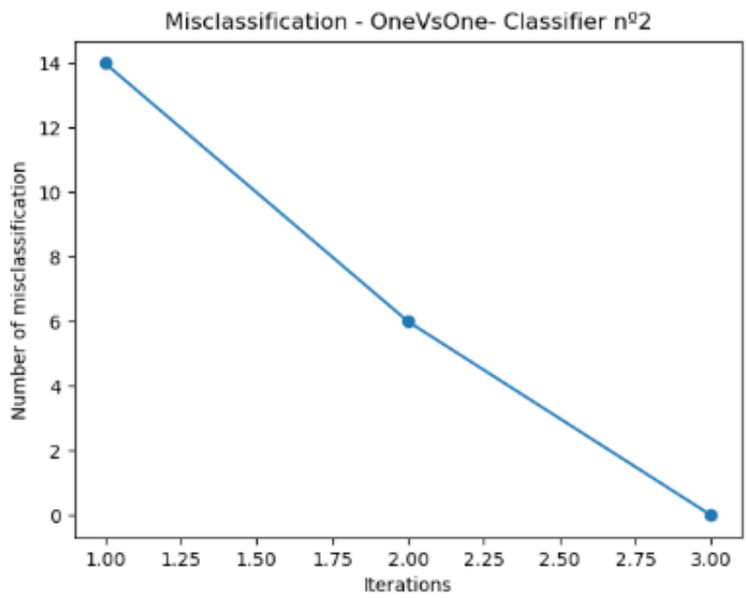

Figura 283: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

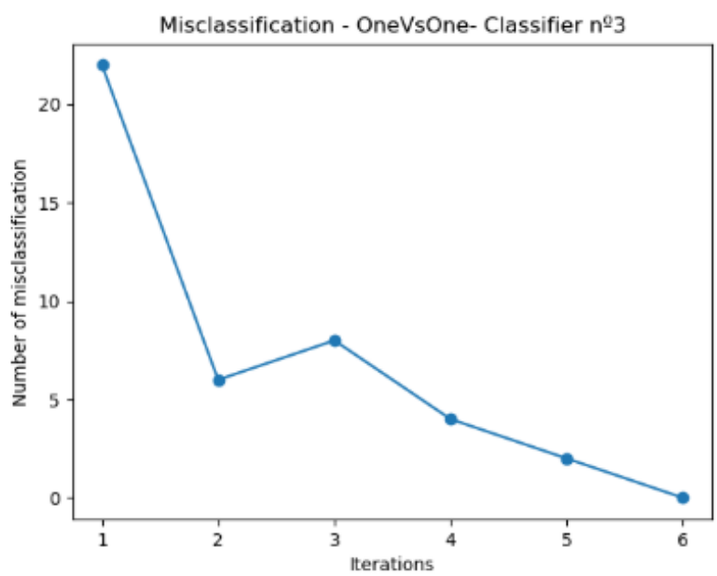

Figura 284: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

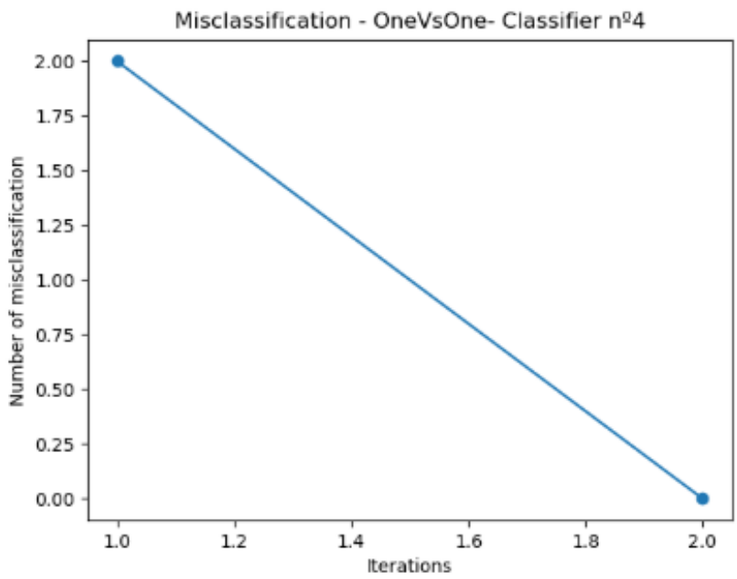

Figura 285: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

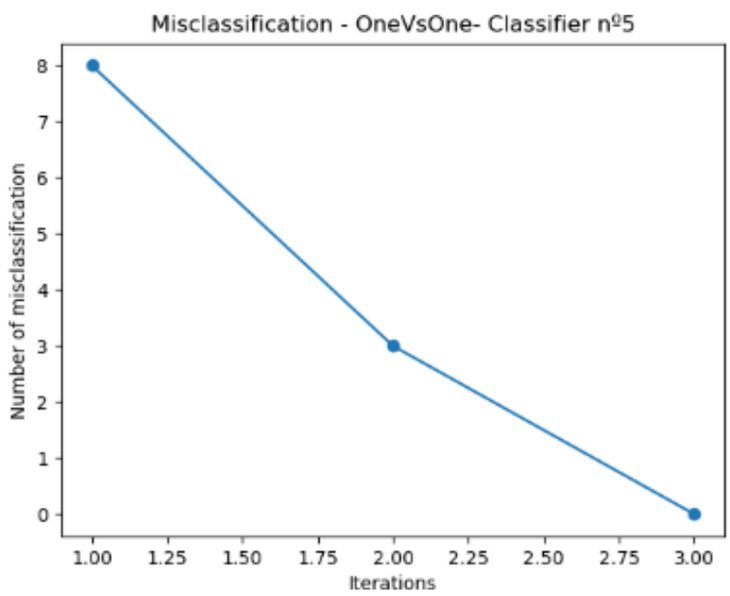

Figura 286: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

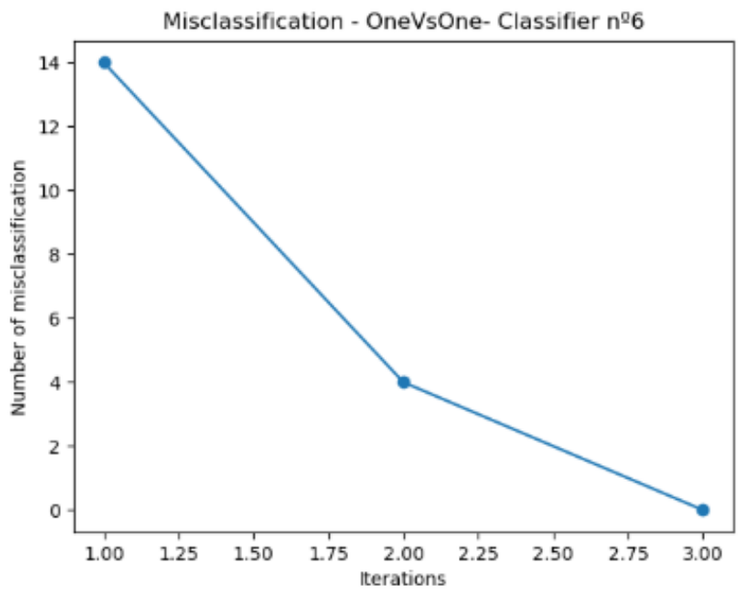

Figura 287: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

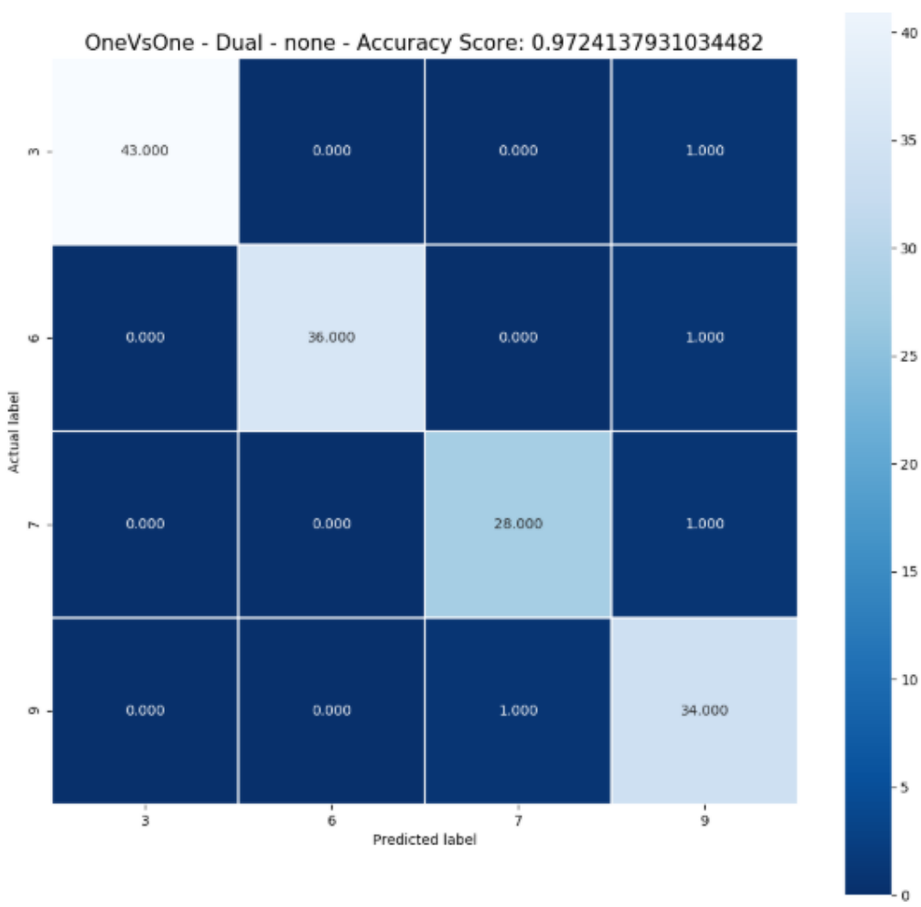

Figura 288: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

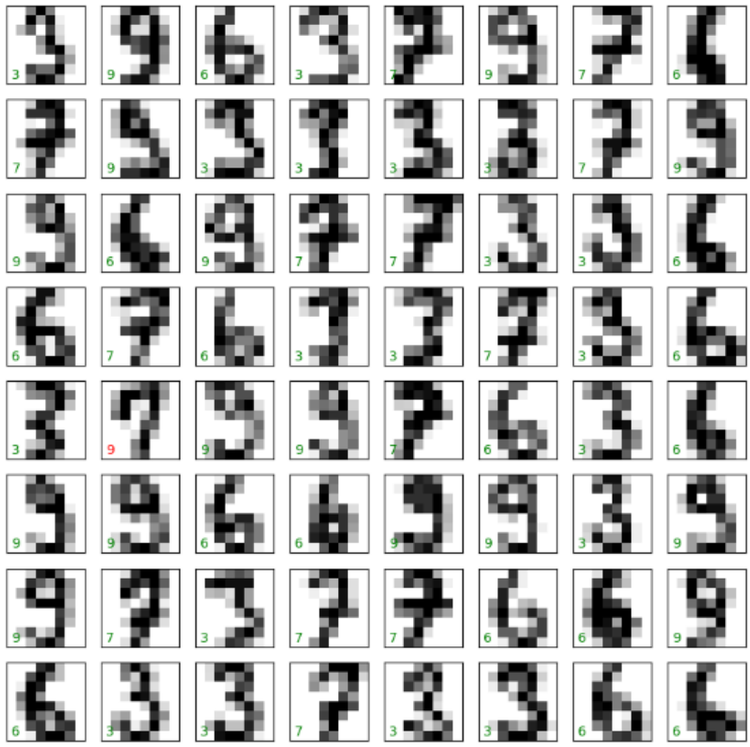

Figura 289: *OneVsOne* — *Predictions* utilizando o *Dataset Digits*

4.6 *Perceptron* Dual com *ECOC*

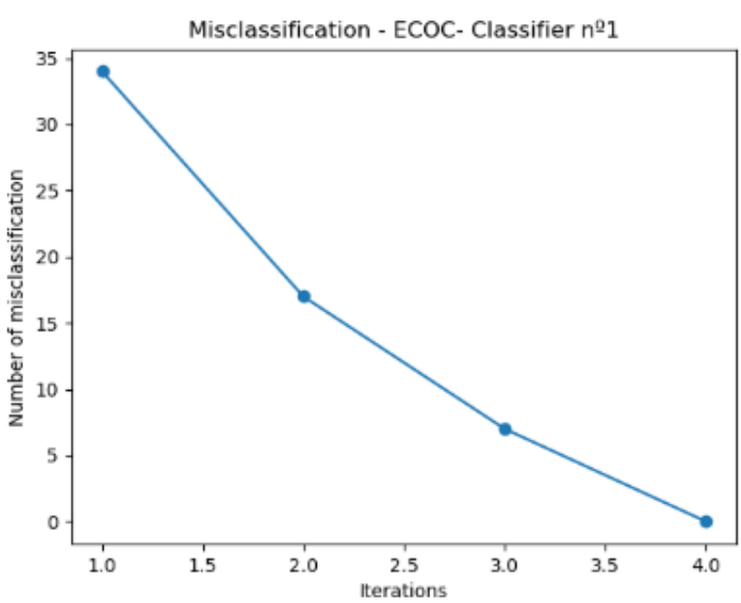

Figura 290: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

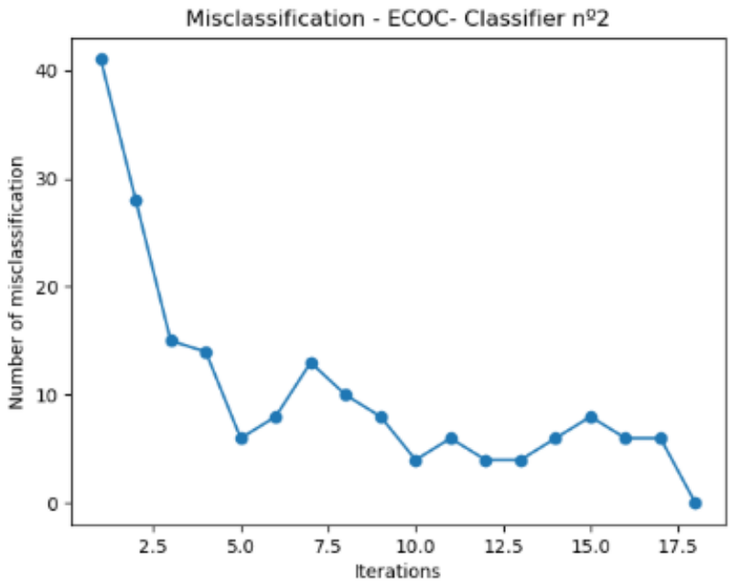

Figura 291: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

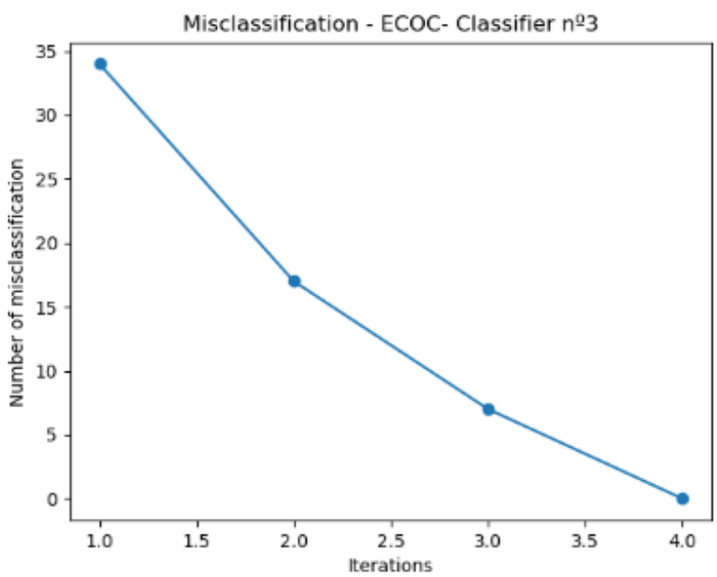

Figura 292: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

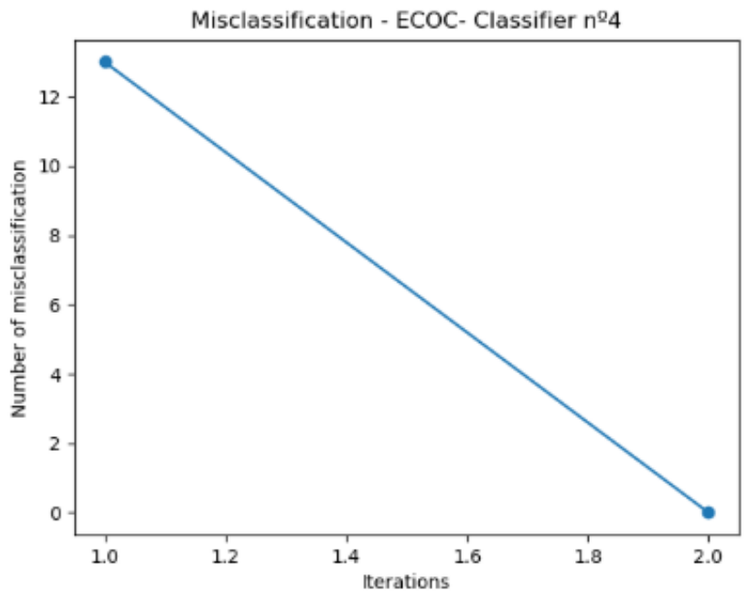

Figura 293: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

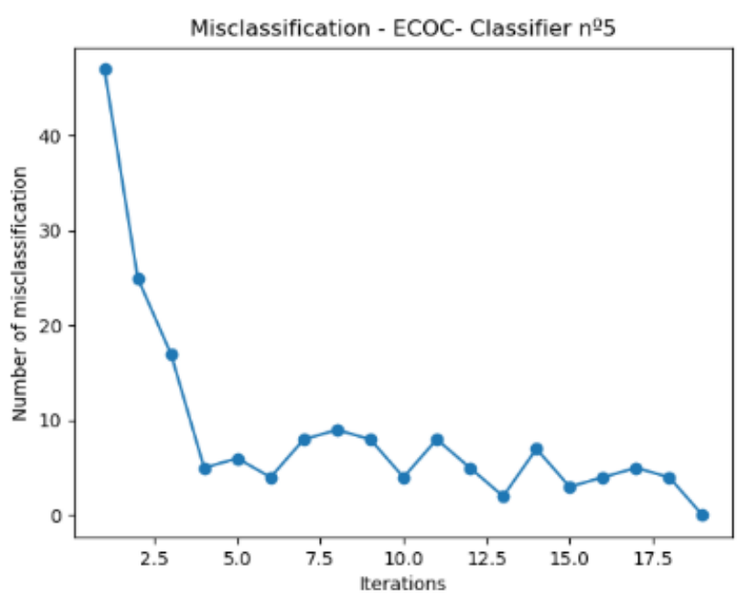

Figura 294: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

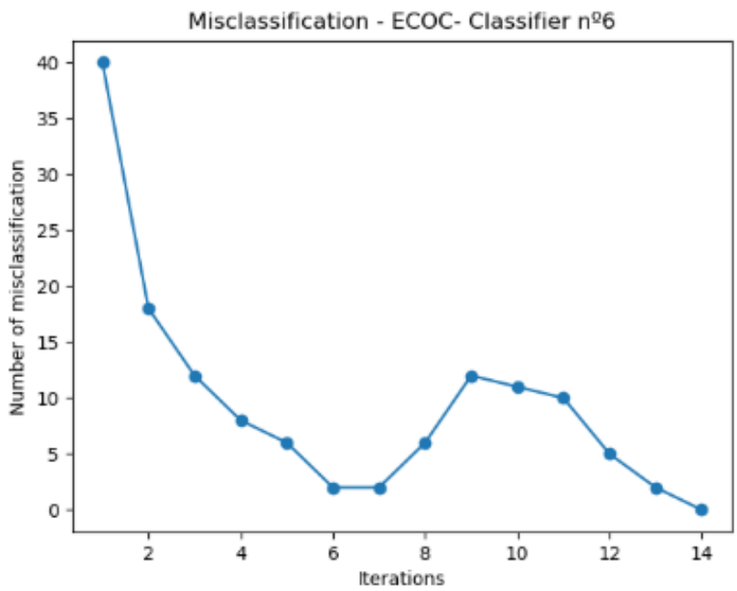

Figura 295: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

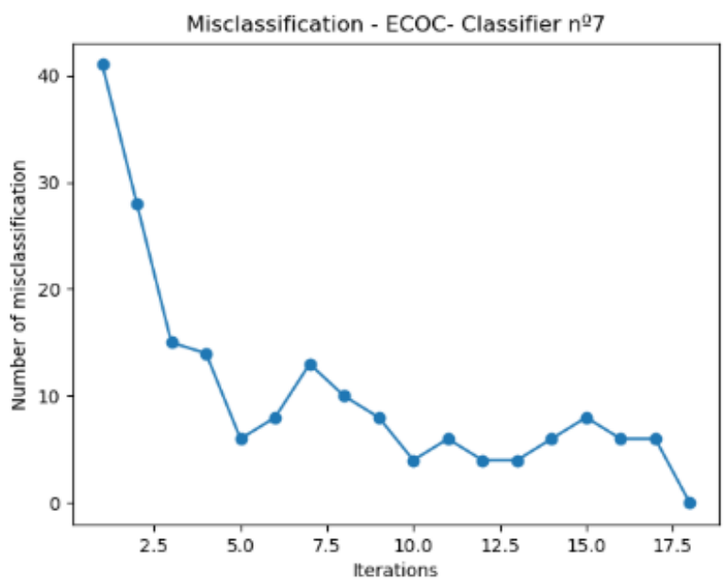

Figura 296: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

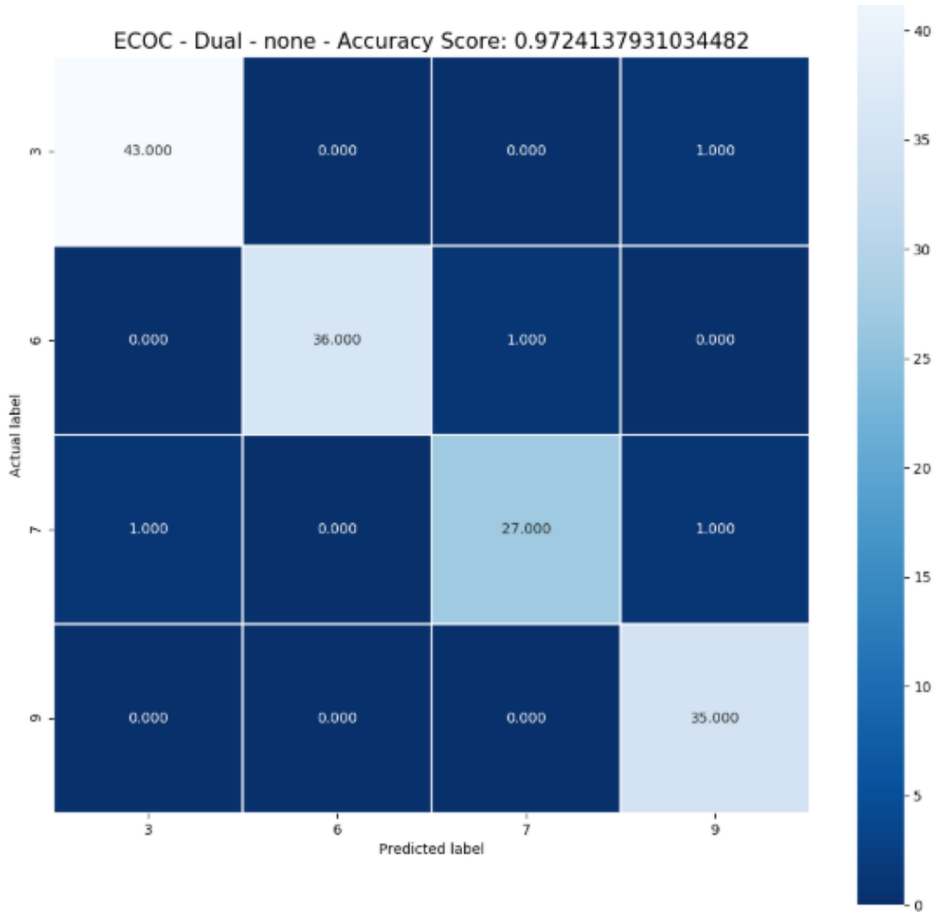

Figura 297: *ECOC — Accuracy* utilizando o *Dataset Digits*

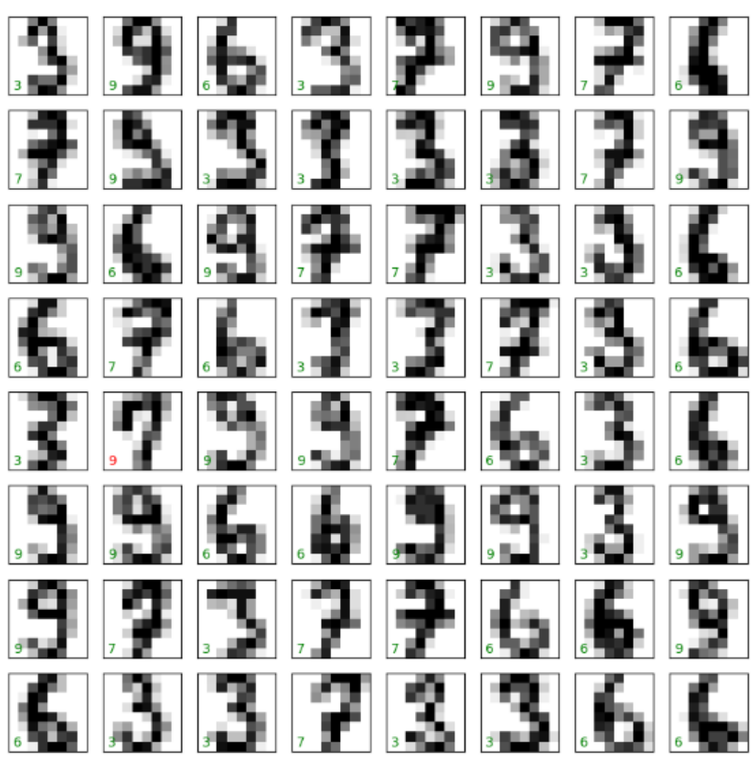

Figura 298: *ECOC — Predictions* utilizando o *Dataset Digits*

4.7 *Perceptron* Dual com *Kernel RBF* com *OVA*

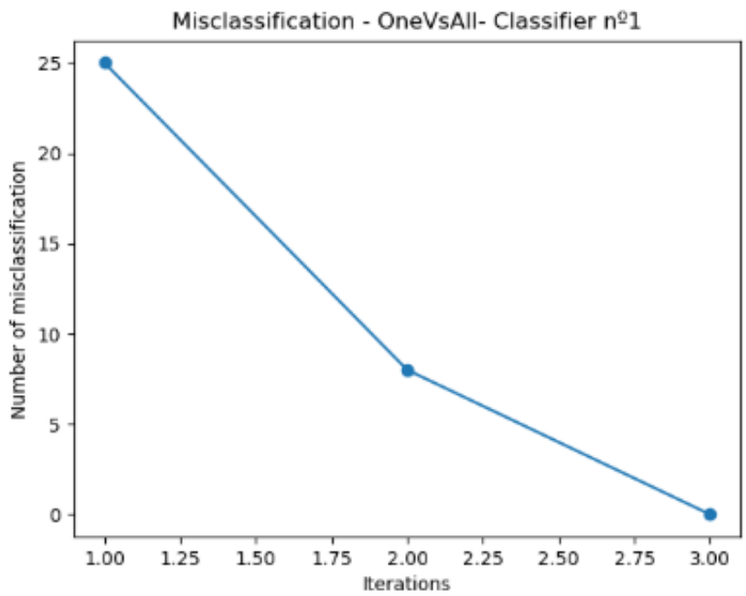

Figura 299: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

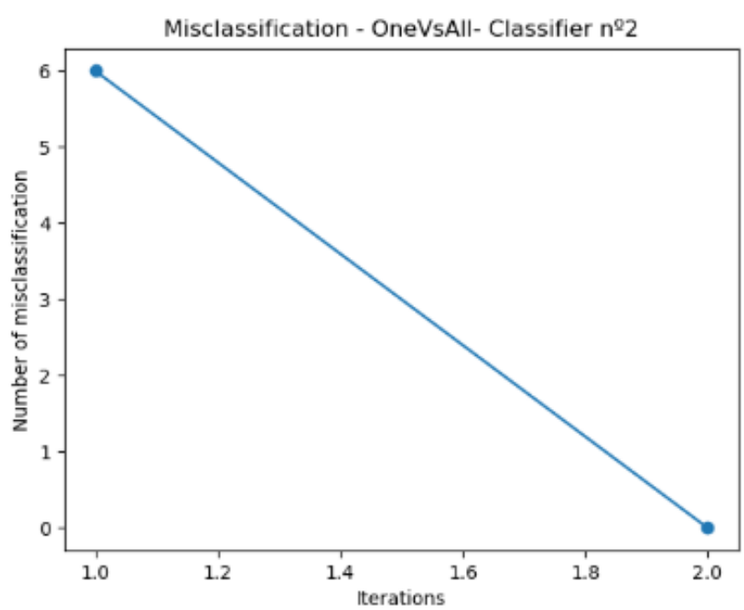

Figura 300: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

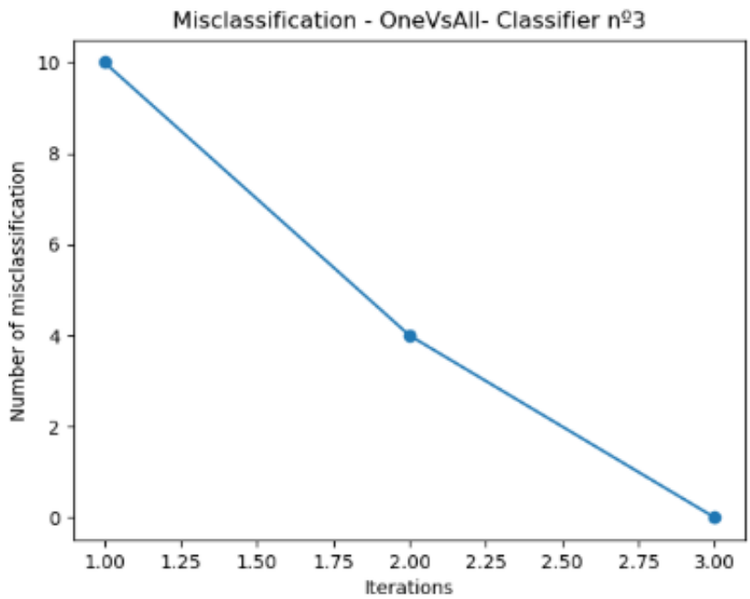

Figura 301: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

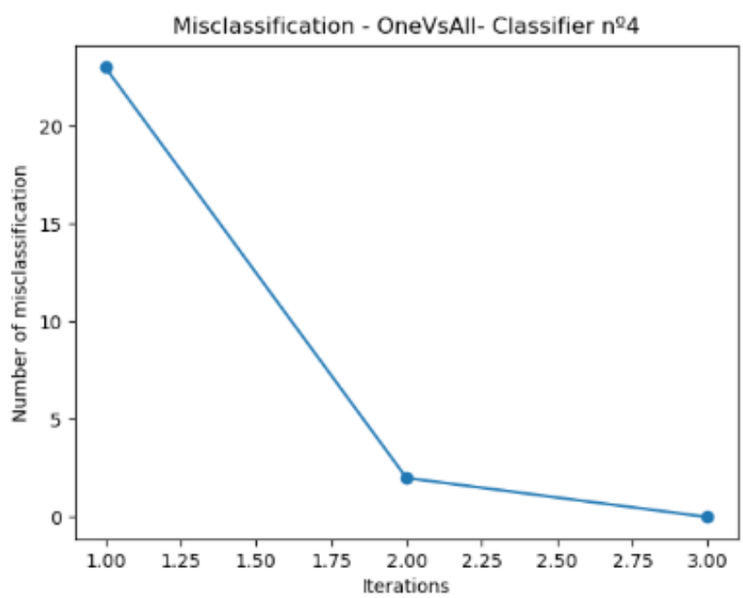

Figura 302: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

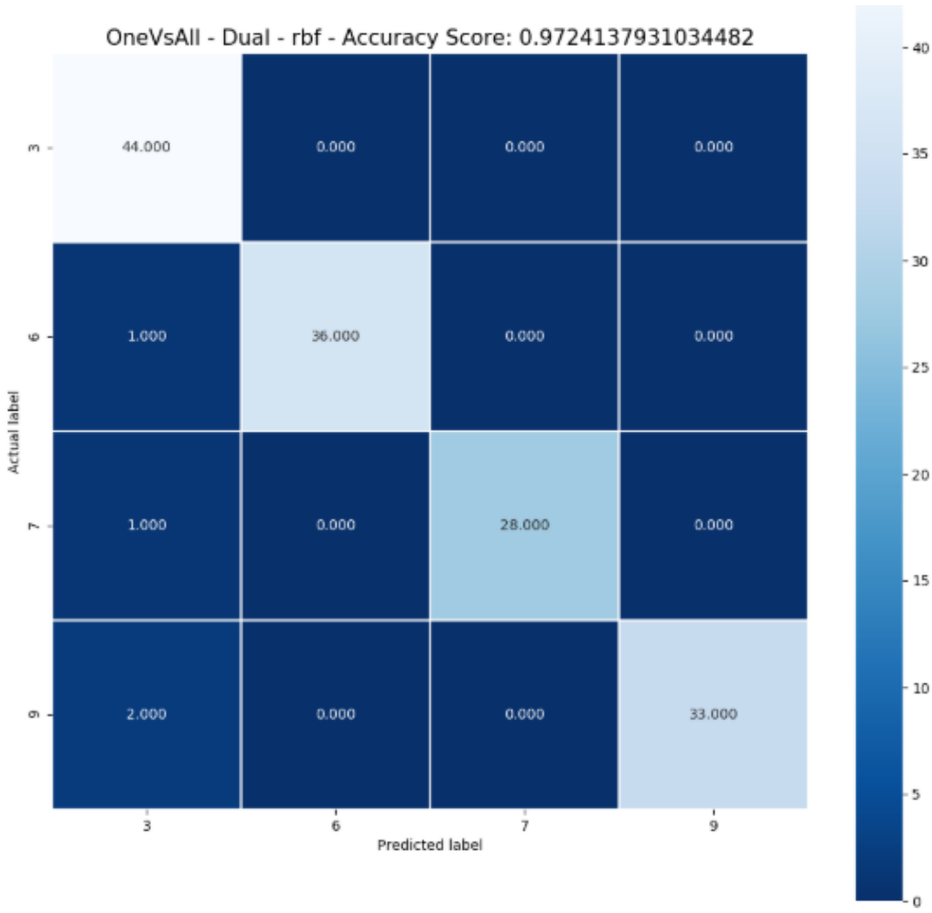

Figura 303: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

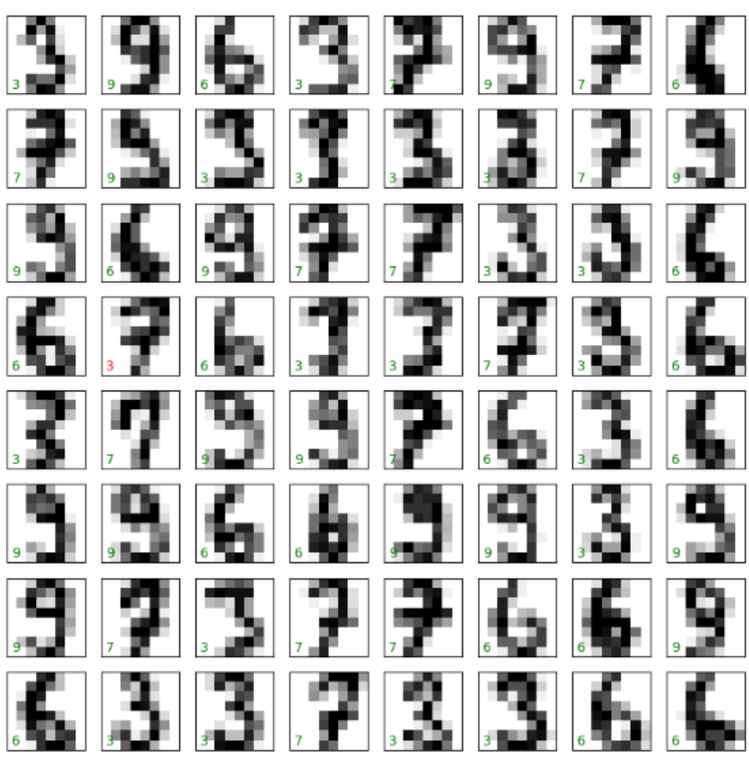

Figura 304: *OneVsAll* — *Predictions* utilizando o *Dataset Digits*

4.8 *Perceptron* Dual com *Kernel RBF* com *OVO*

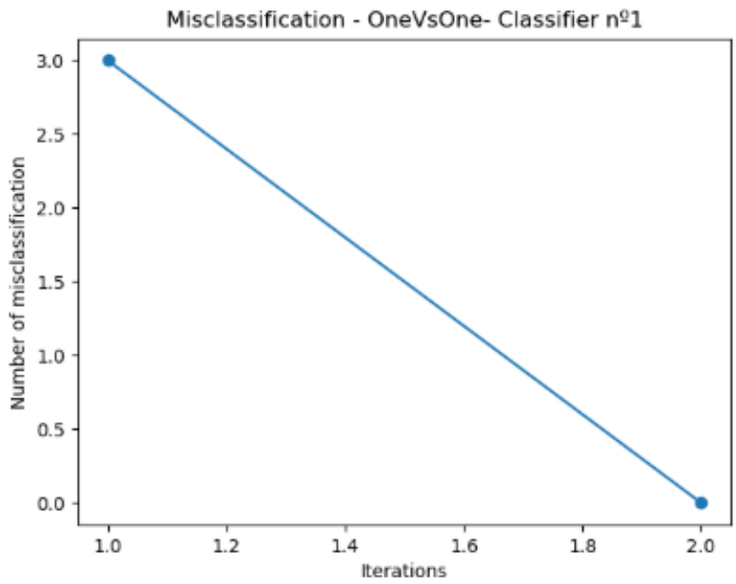

Figura 305: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

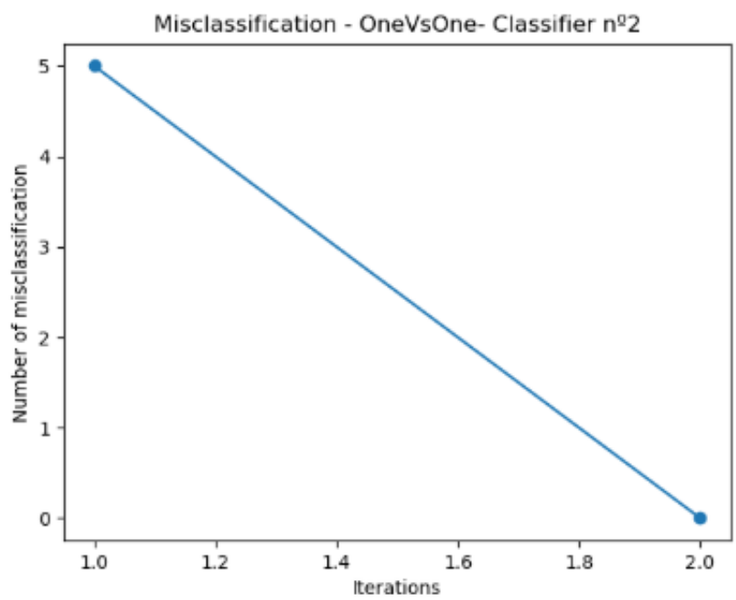

Figura 306: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

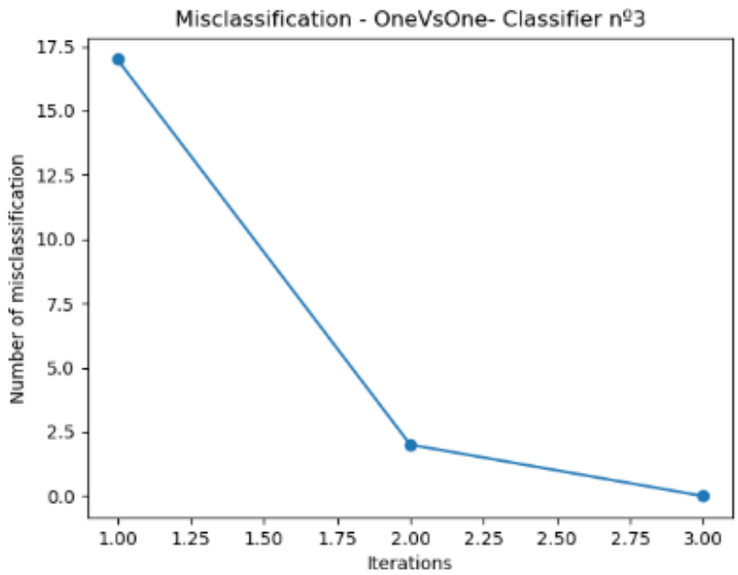

Figura 307: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

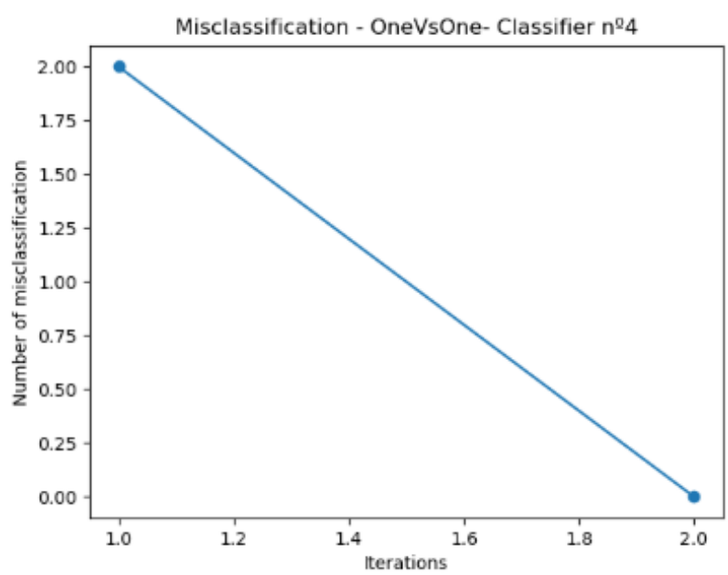

Figura 308: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

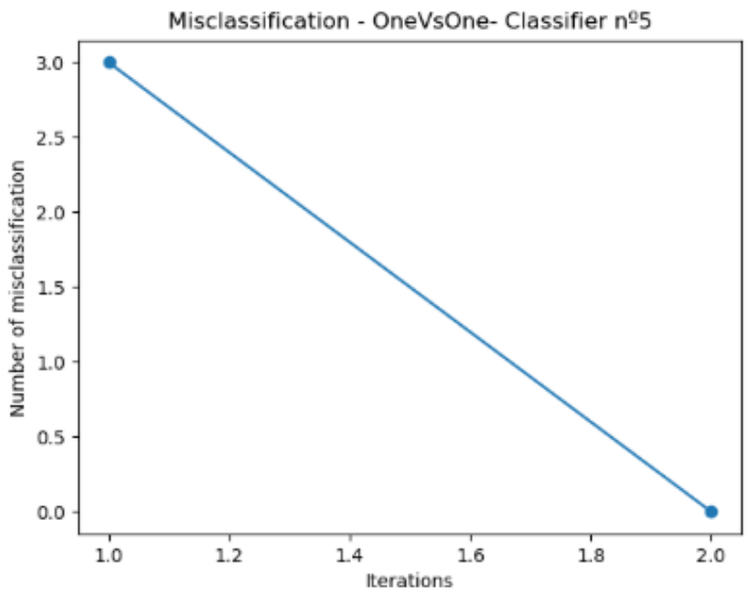

Figura 309: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

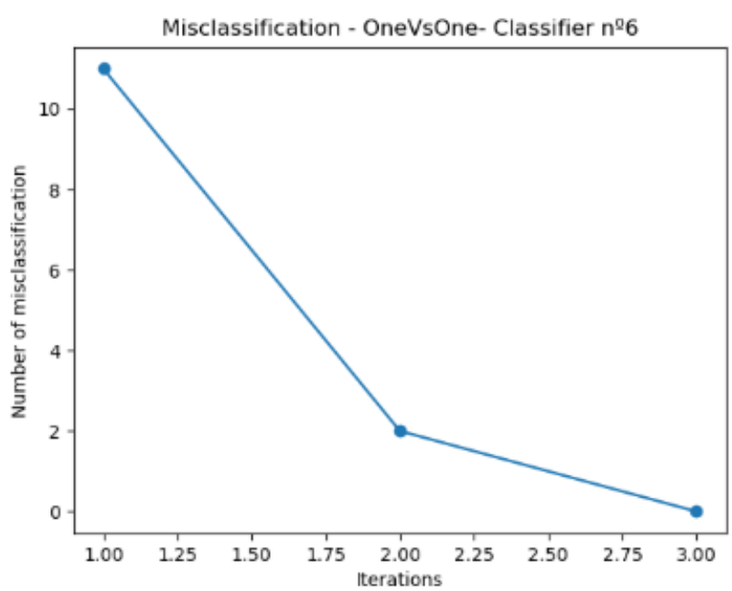

Figura 310: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

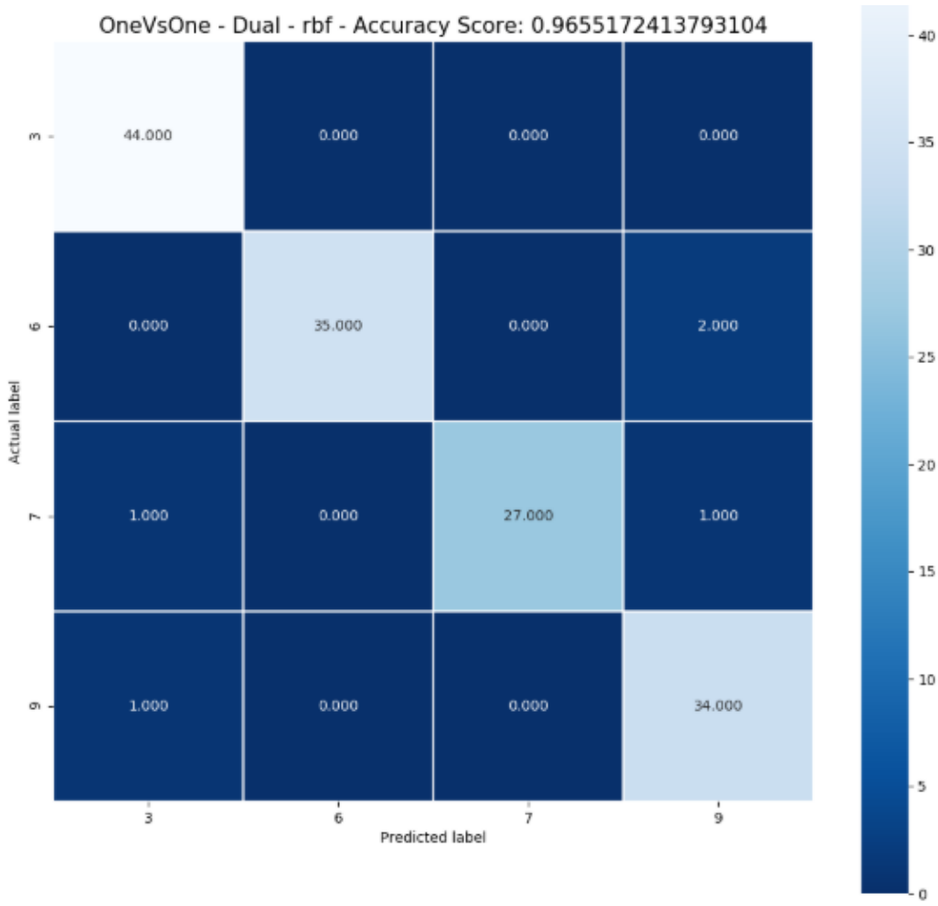

Figura 311: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

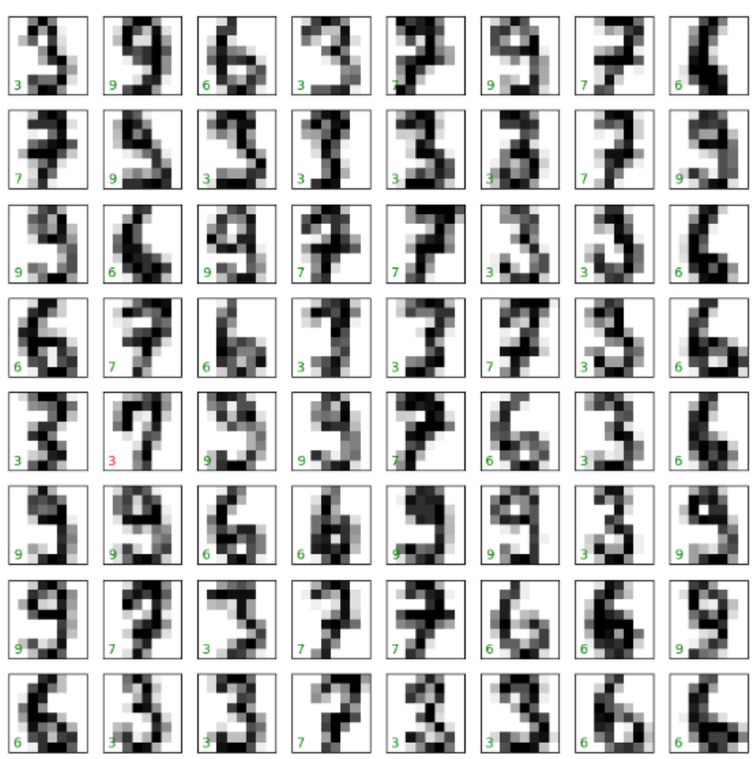

Figura 312: *OneVsOne* — *Predictions* utilizando o *Dataset Digits*

4.9 *Perceptron* Dual com *Kernel RBF* com *ECOC*

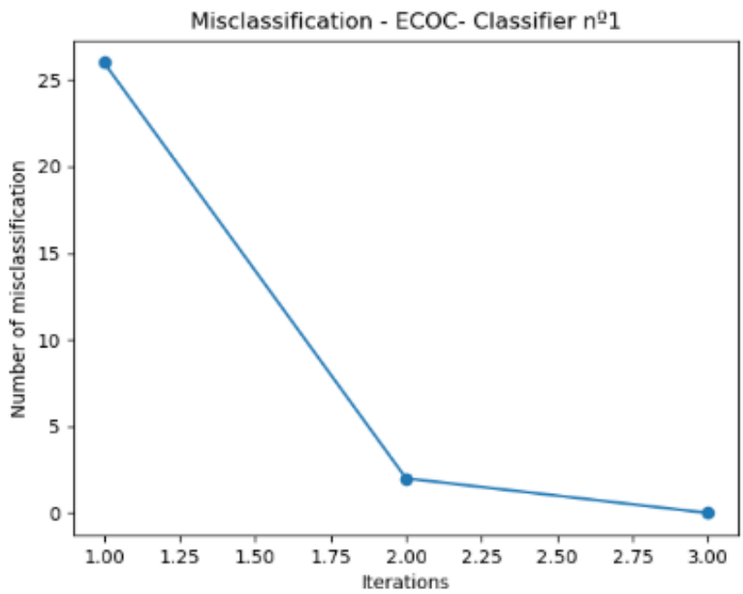

Figura 313: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

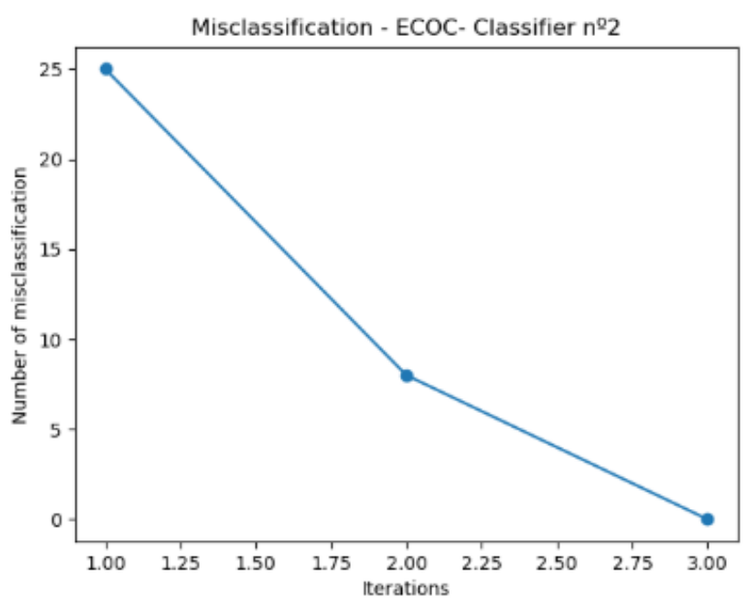

Figura 314: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

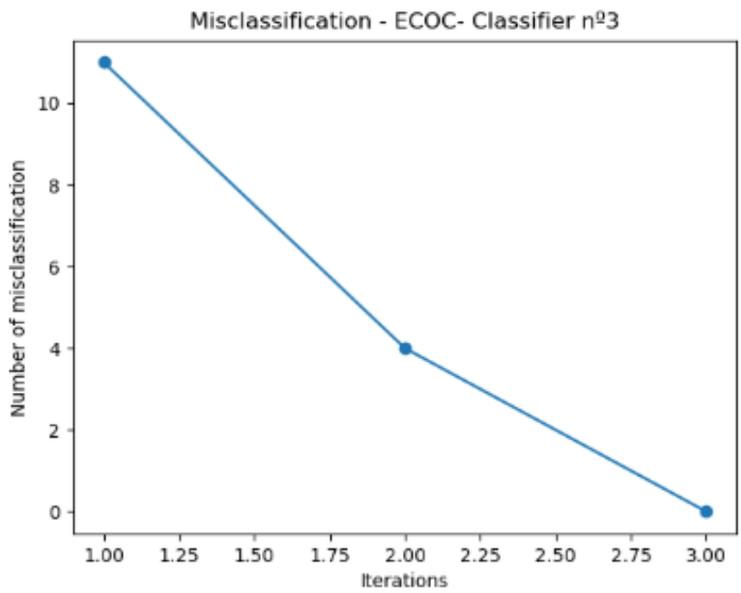

Figura 315: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

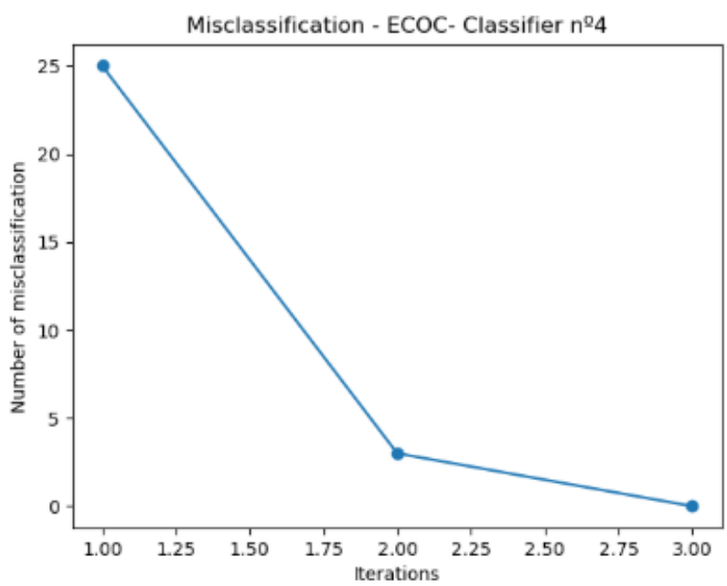

Figura 316: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

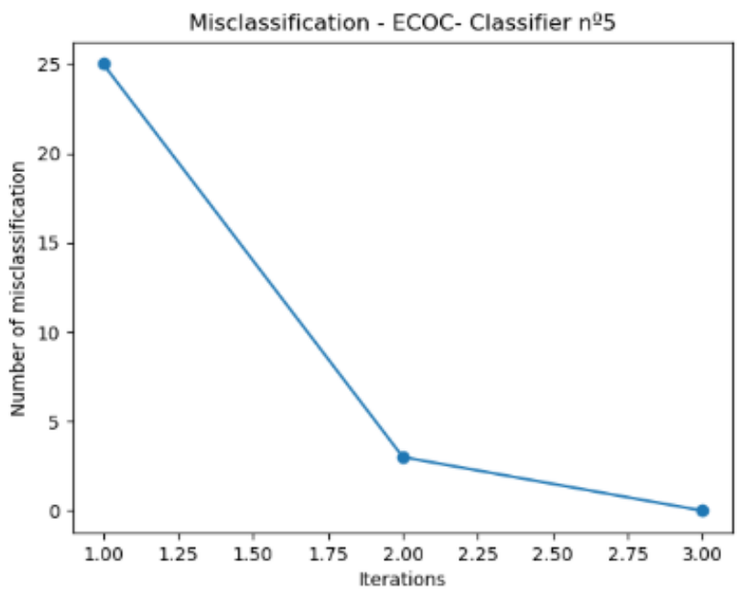

Figura 317: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

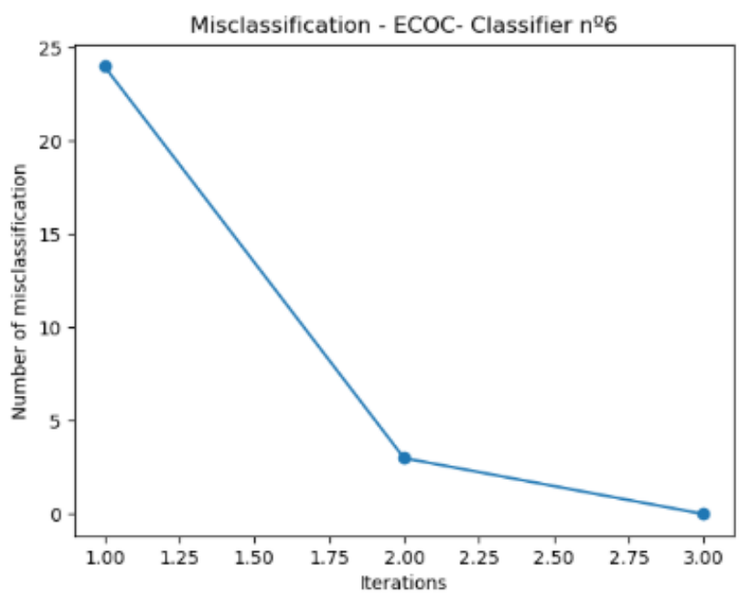

Figura 318: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

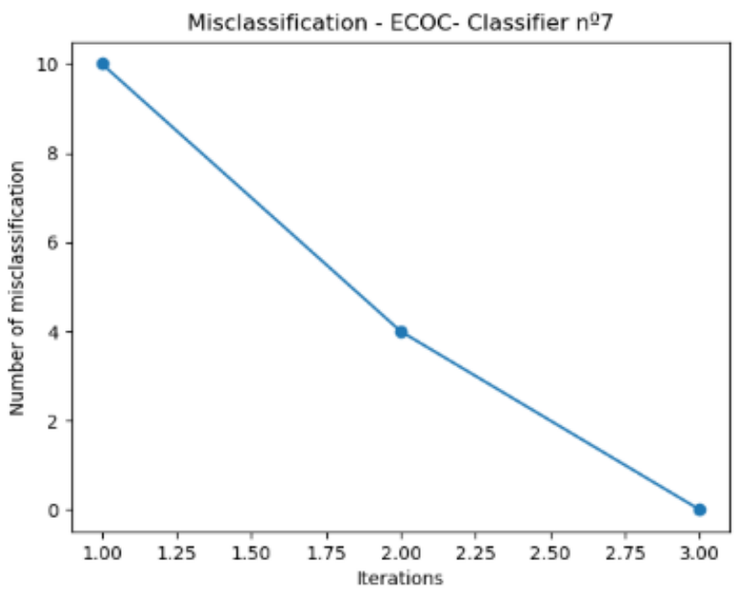

Figura 319: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

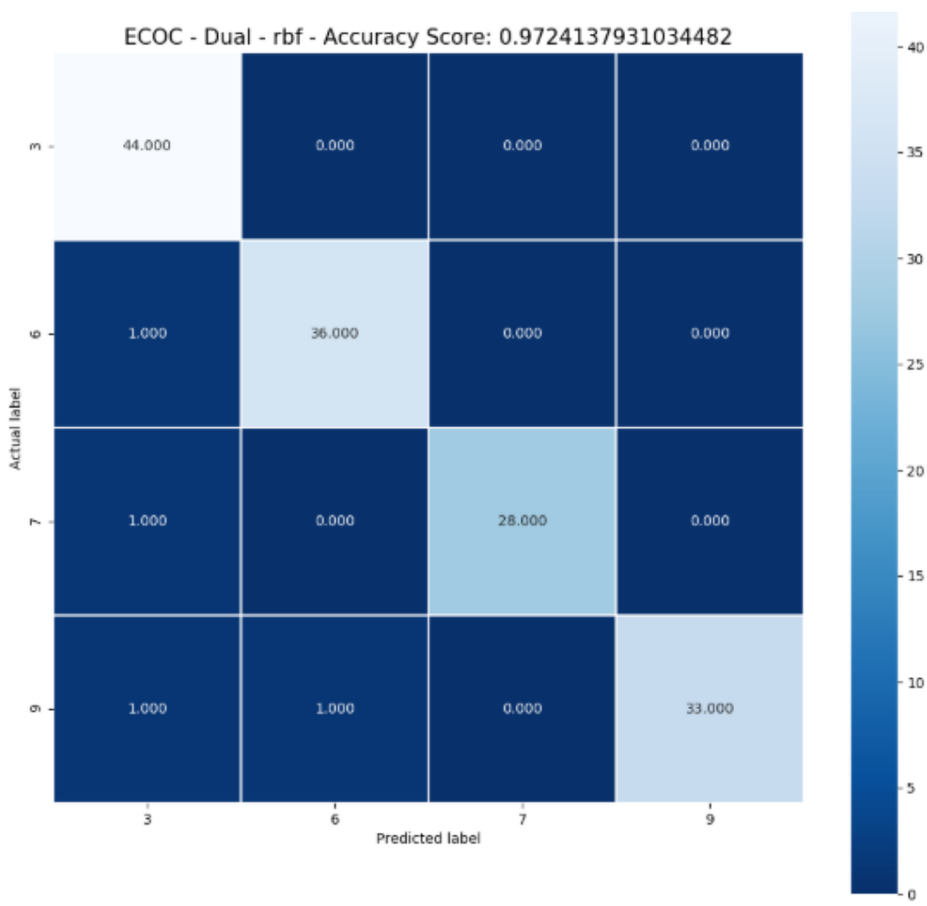

Figura 320: *ECOC* — *Accuracy* utilizando o *Dataset Digits*

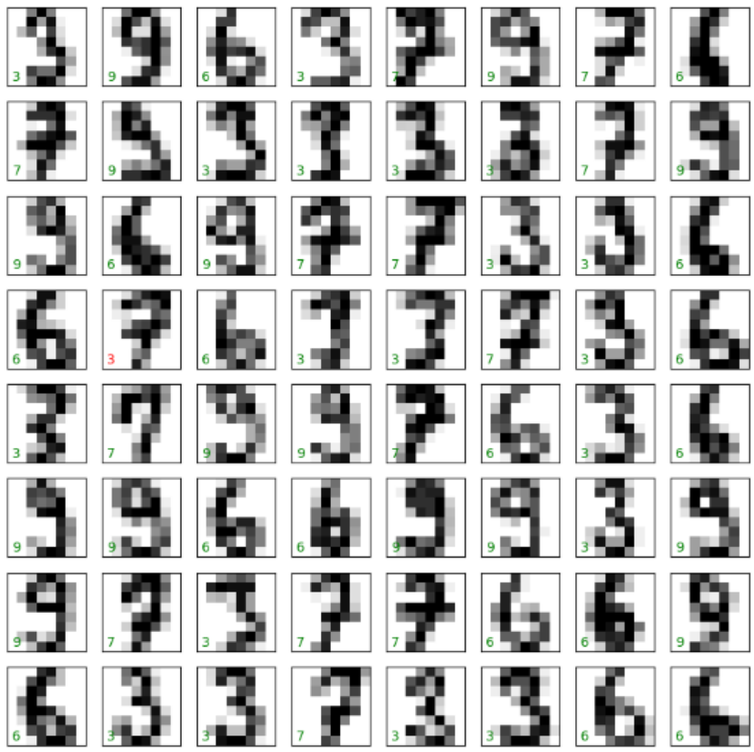

Figura 321: *ECOC* — *Predictions* utilizando o *Dataset Digits*

4.10 *Perceptron* Dual com *Kernel* Polinomial com *OVA*

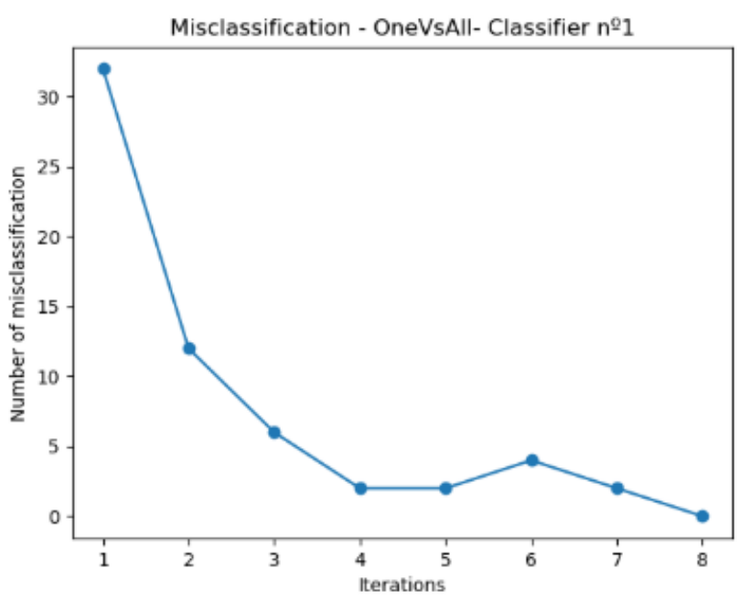

Figura 322: *OneVsAll* — erro no primeiro classificador utilizando o *Dataset Digits*

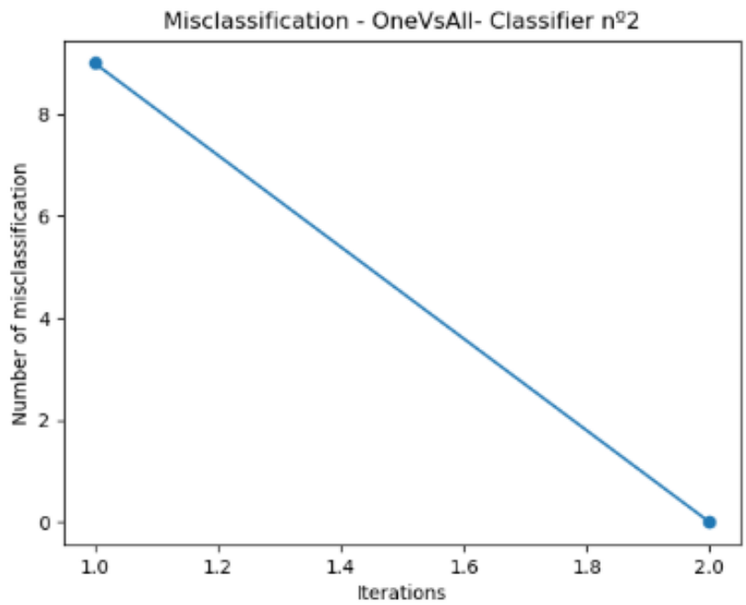

Figura 323: *OneVsAll* — erro no segundo classificador utilizando o *Dataset Digits*

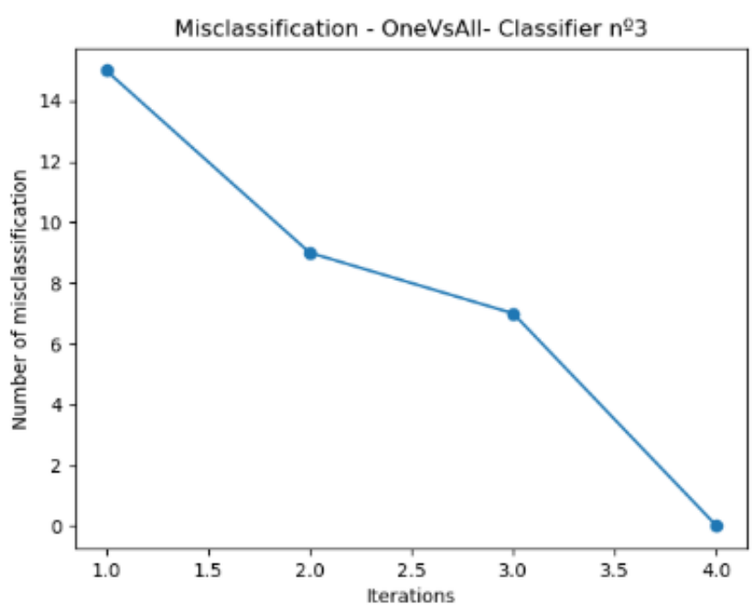

Figura 324: *OneVsAll* — erro no terceiro classificador utilizando o *Dataset Digits*

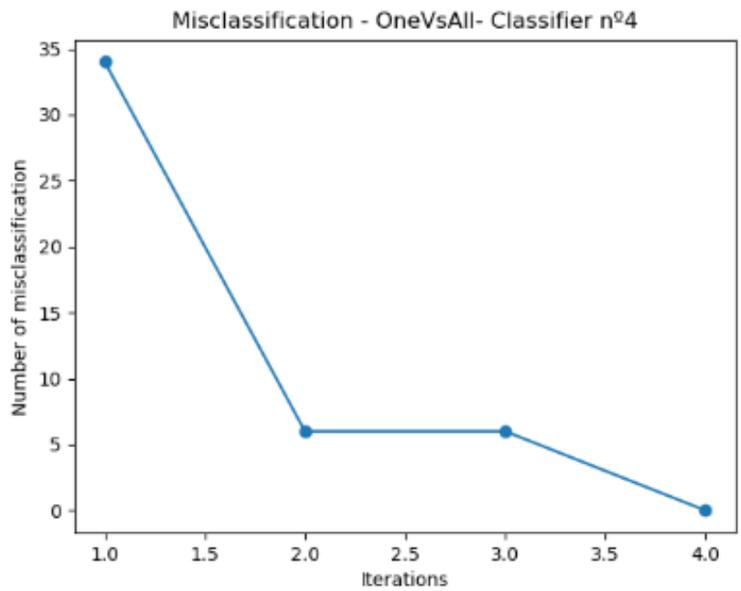

Figura 325: *OneVsAll* — erro no quarto classificador utilizando o *Dataset Digits*

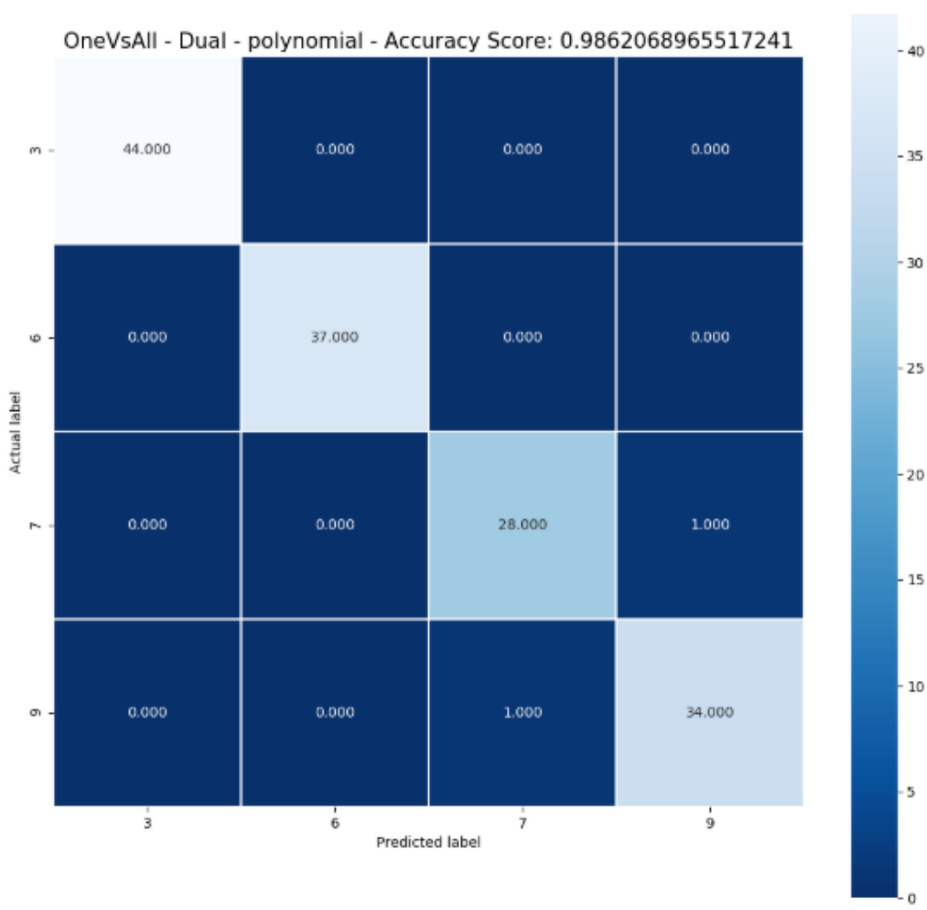

Figura 326: *OneVsAll* — *Accuracy* utilizando o *Dataset Digits*

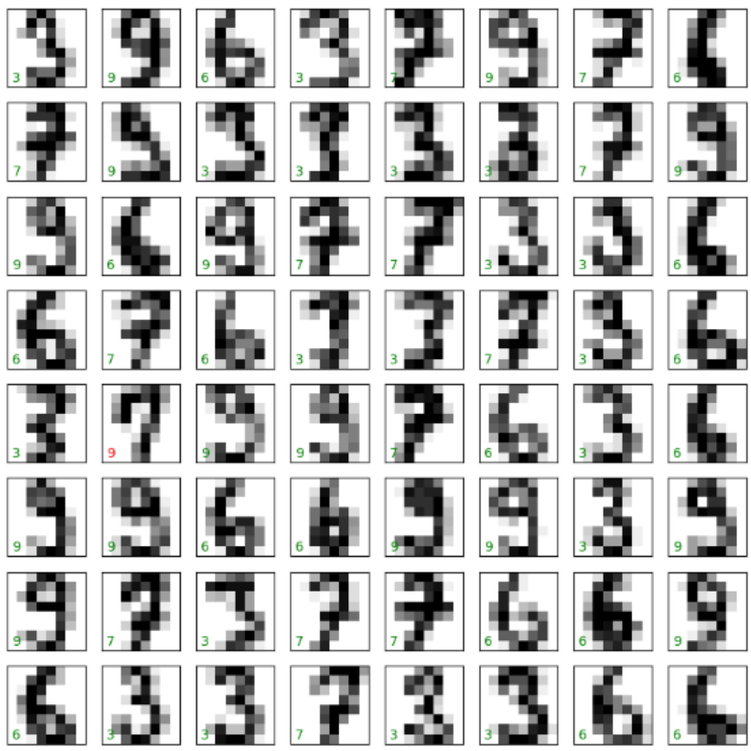

Figura 327: *OneVsAll* — *Predictions* utilizando o *Dataset Digits*

4.11 *Perceptron* Dual com *Kernel* Polinomial com *OVO*

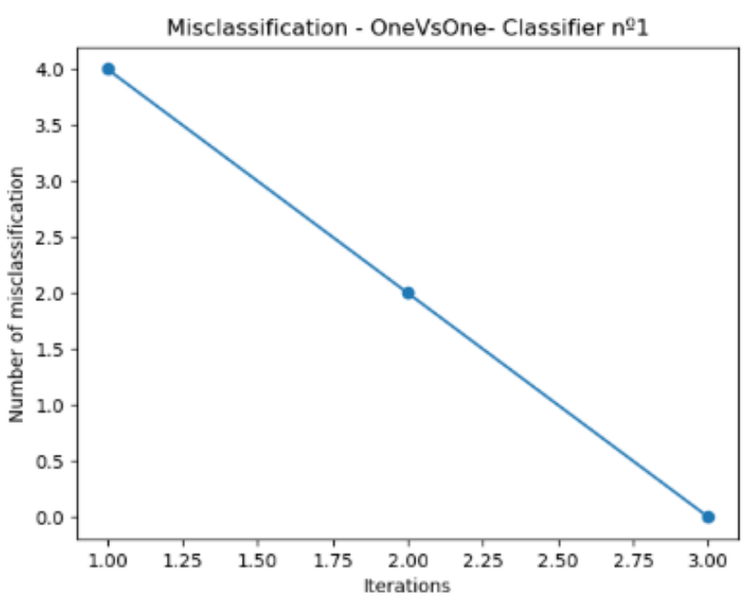

Figura 328: *OneVsOne* — erro no primeiro classificador utilizando o *Dataset Digits*

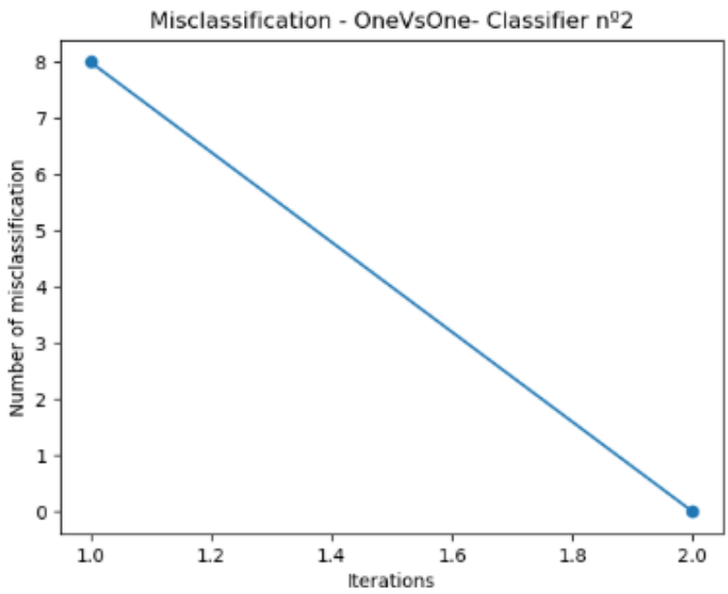

Figura 329: *OneVsOne* — erro no segundo classificador utilizando o *Dataset Digits*

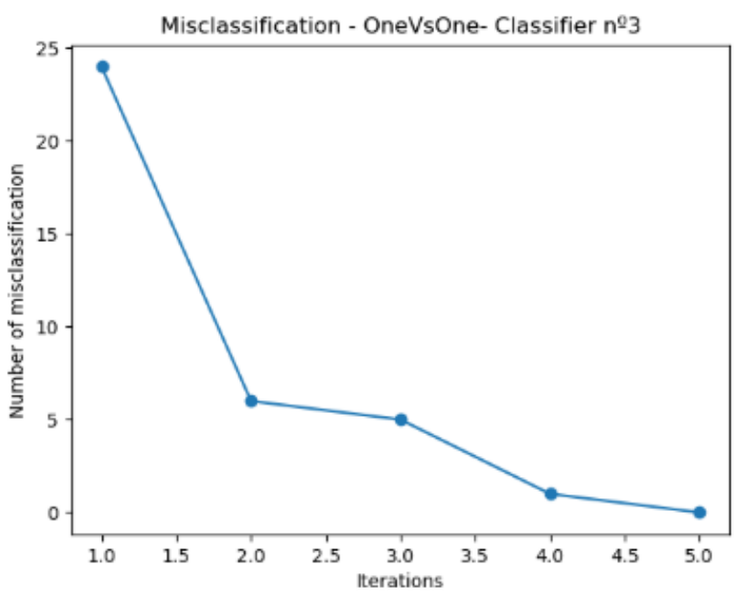

Figura 330: *OneVsOne* — erro no terceiro classificador utilizando o *Dataset Digits*

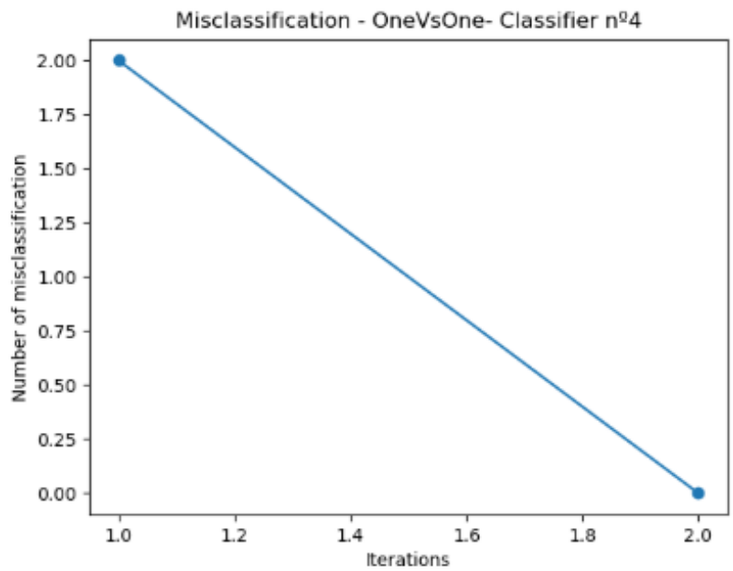

Figura 331: *OneVsOne* — erro no quarto classificador utilizando o *Dataset Digits*

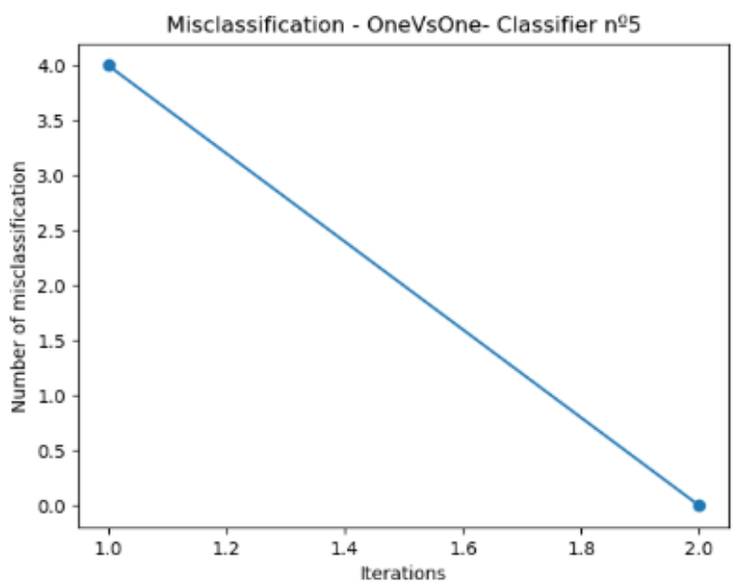

Figura 332: *OneVsOne* — erro no quinto classificador utilizando o *Dataset Digits*

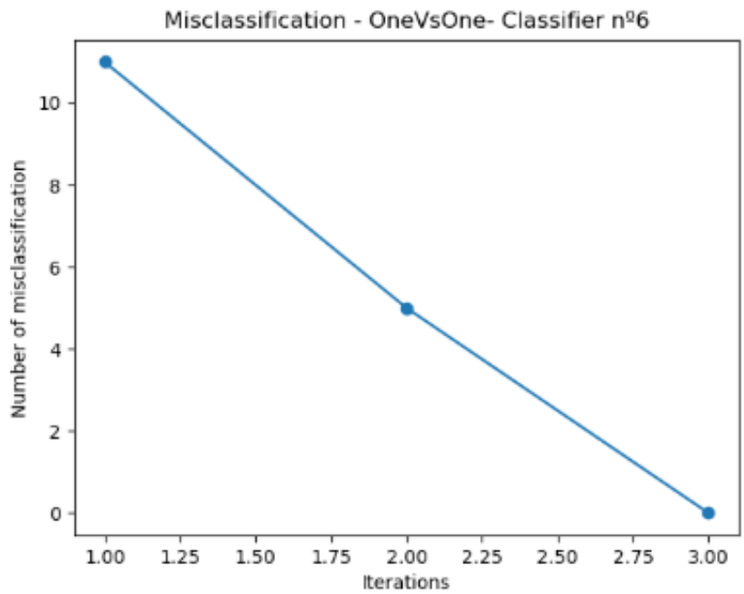

Figura 333: *OneVsOne* — erro no sexto classificador utilizando o *Dataset Digits*

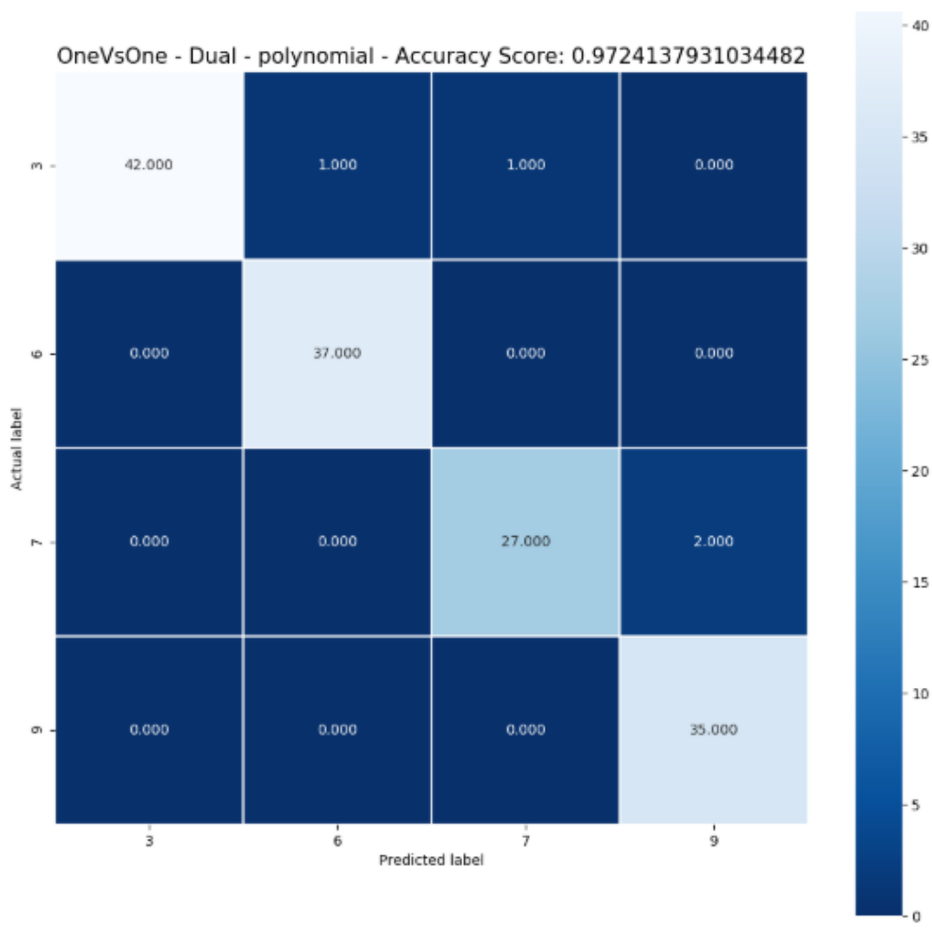

Figura 334: *OneVsOne* — *Accuracy* utilizando o *Dataset Digits*

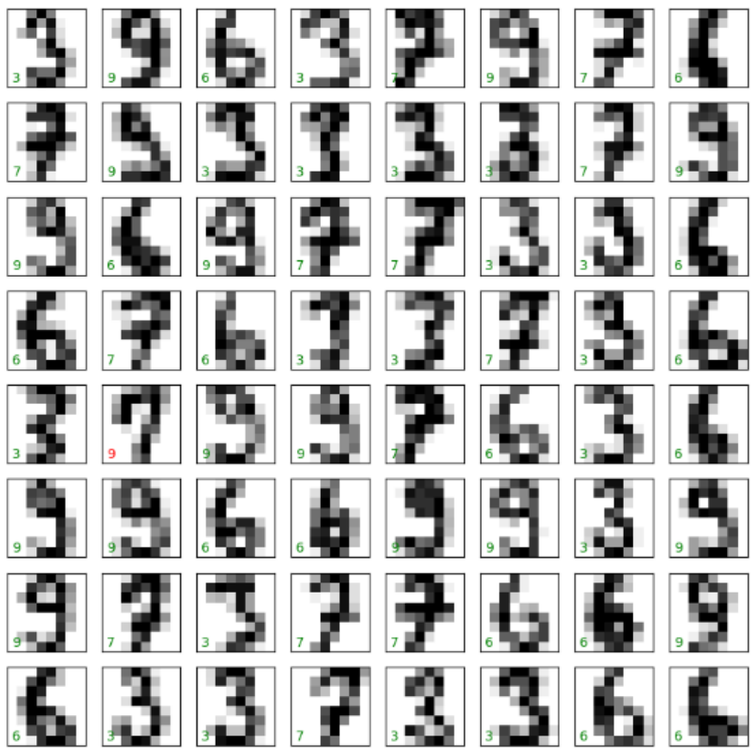

Figura 335: *OneVsOne* — *Predictions* utilizando o *Dataset Digits*

4.12 *Perceptron* Dual com *Kernel* Polinomial com *ECOC*

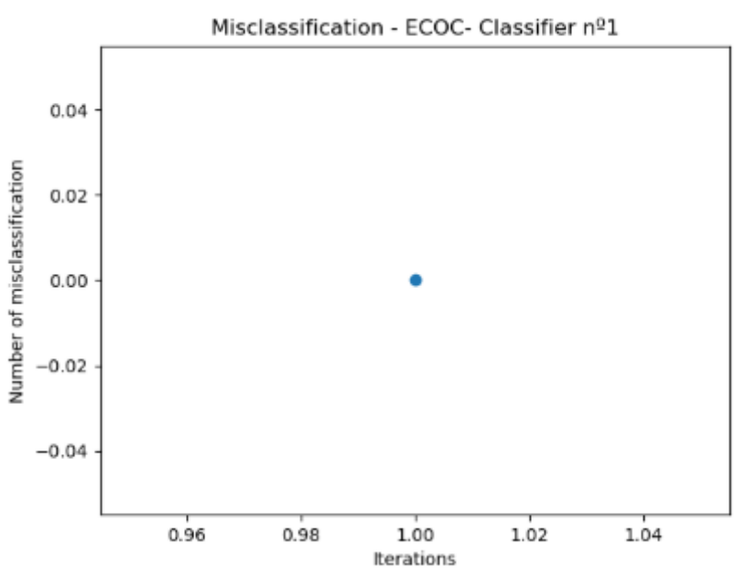

Figura 336: *ECOC* — erro no primeiro classificador utilizando o *Dataset Digits*

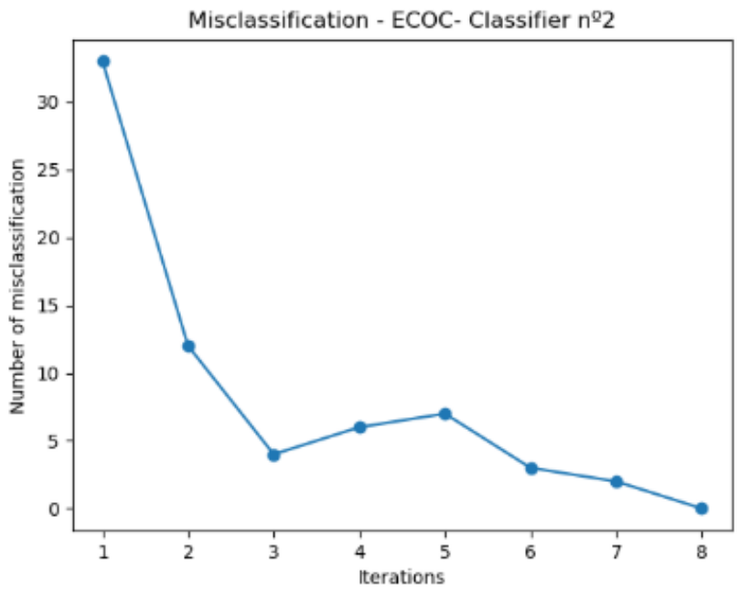

Figura 337: *ECOC* — erro no segundo classificador utilizando o *Dataset Digits*

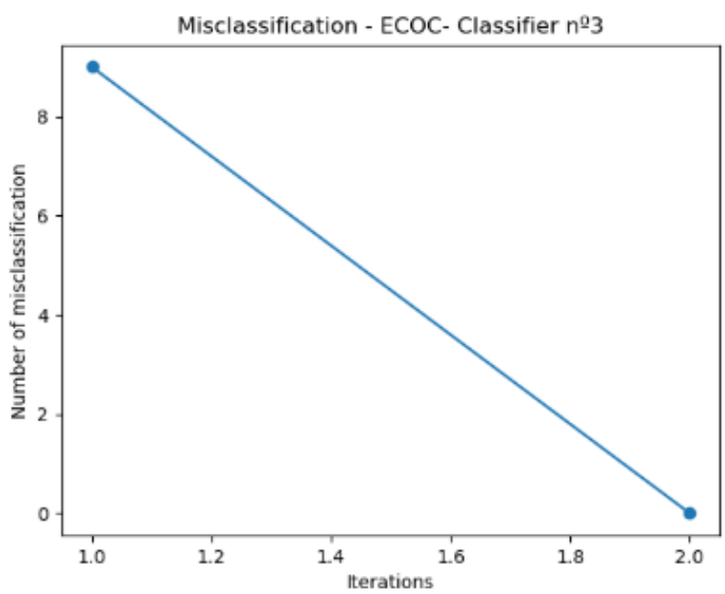

Figura 338: *ECOC* — erro no terceiro classificador utilizando o *Dataset Digits*

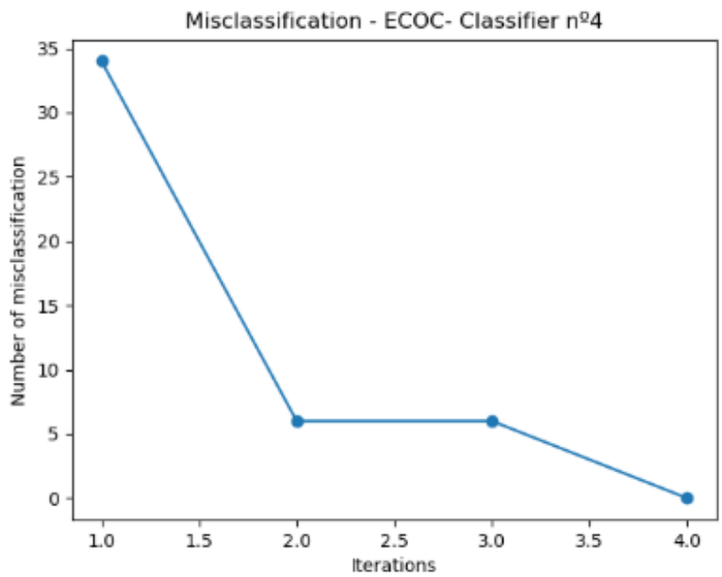

Figura 339: *ECOC* — erro no quarto classificador utilizando o *Dataset Digits*

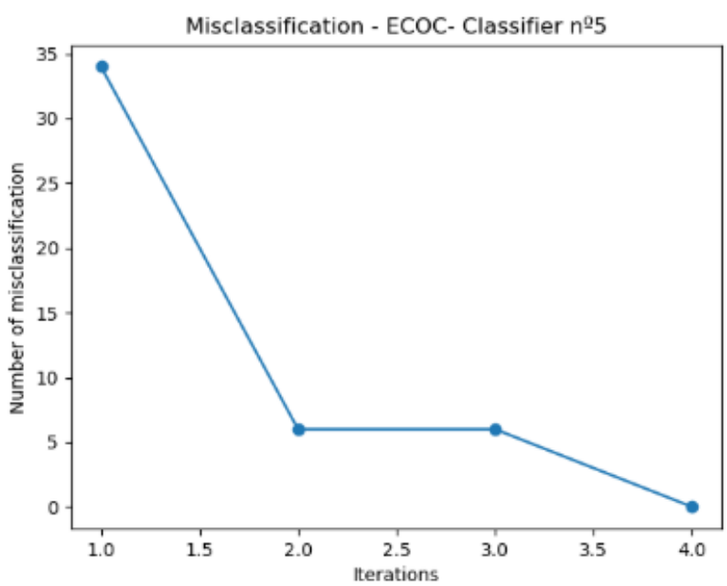

Figura 340: *ECOC* — erro no quinto classificador utilizando o *Dataset Digits*

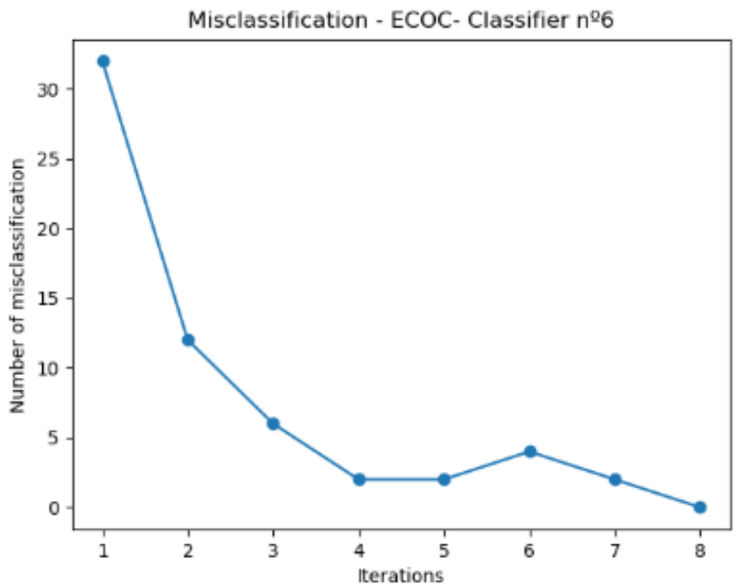

Figura 341: *ECOC* — erro no sexto classificador utilizando o *Dataset Digits*

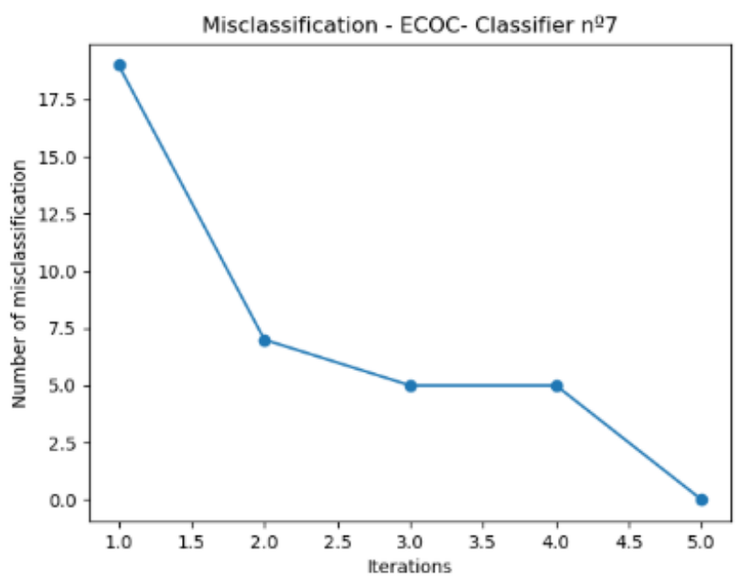

Figura 342: *ECOC* — erro no sétimo classificador utilizando o *Dataset Digits*

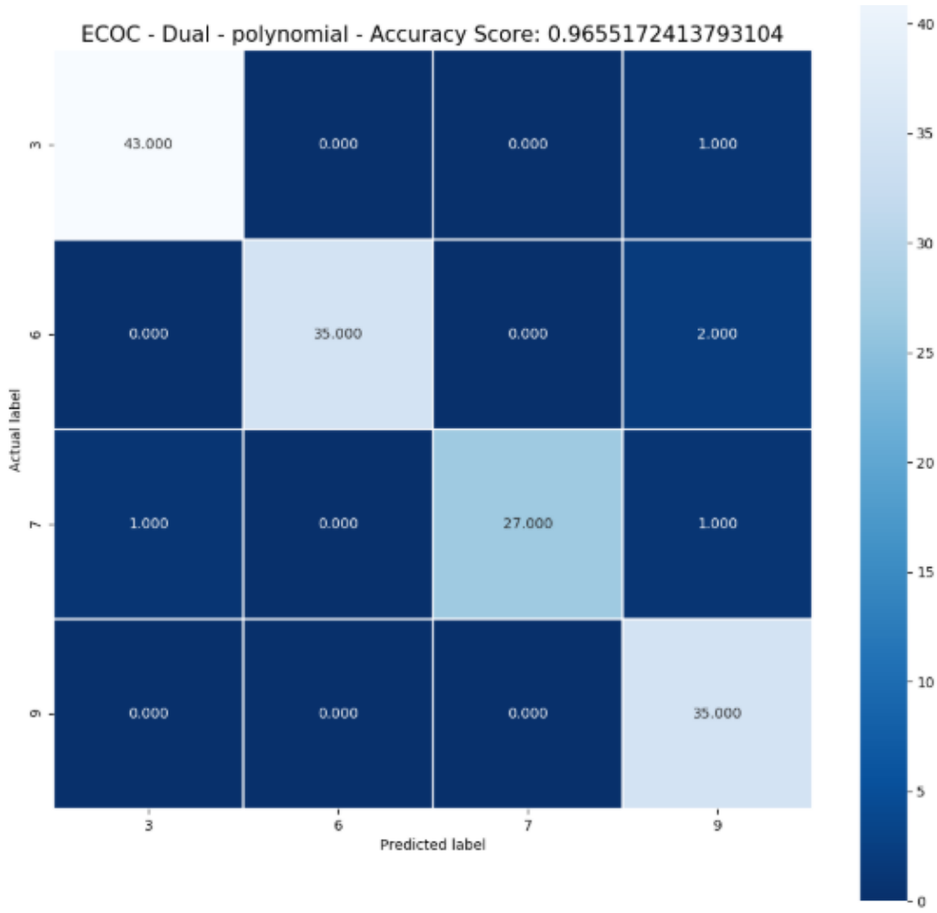

Figura 343: *ECOC — Accuracy* utilizando o *Dataset Digits*

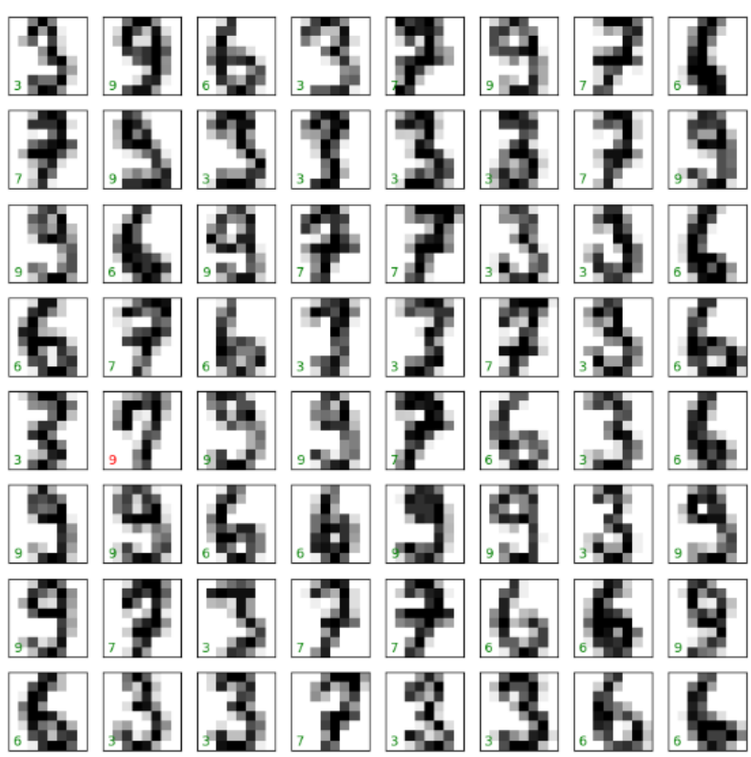

Figura 344: *ECOC — Predictions* utilizando o *Dataset Digits*

5 Resultados *Scikit-learn* com *Dataset Digits* para as classes 0123

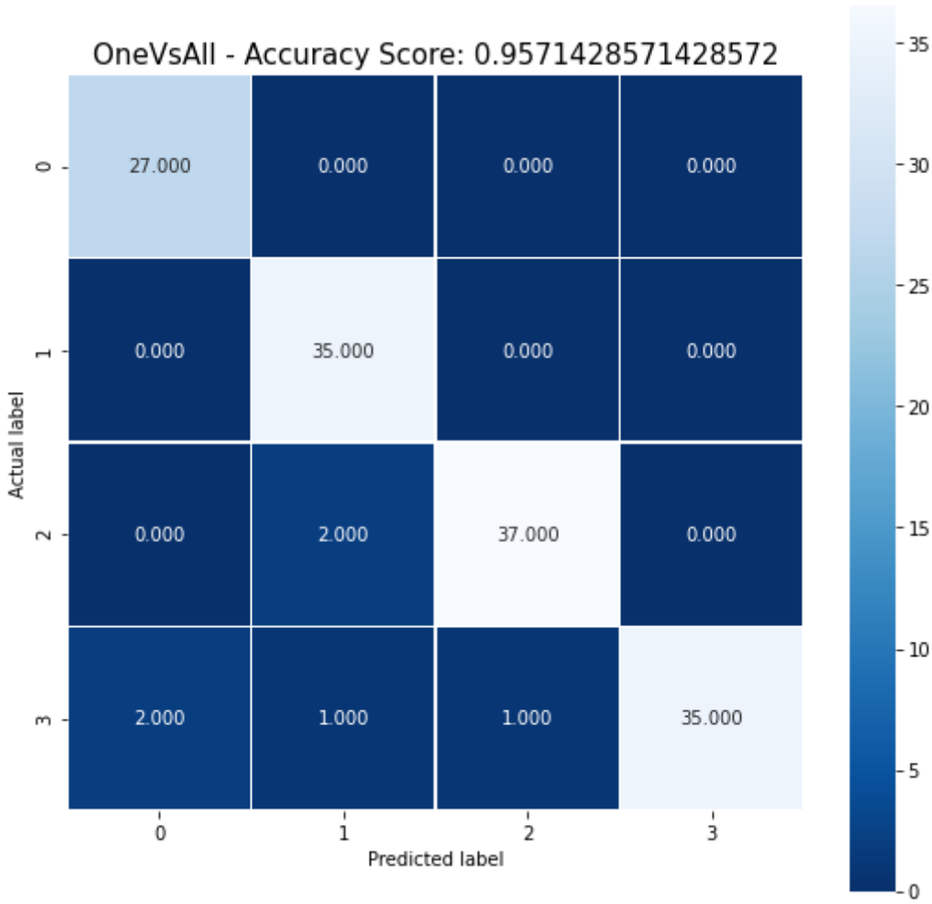

Figura 345: *Scikit-learn OneVsAll Accuracy*

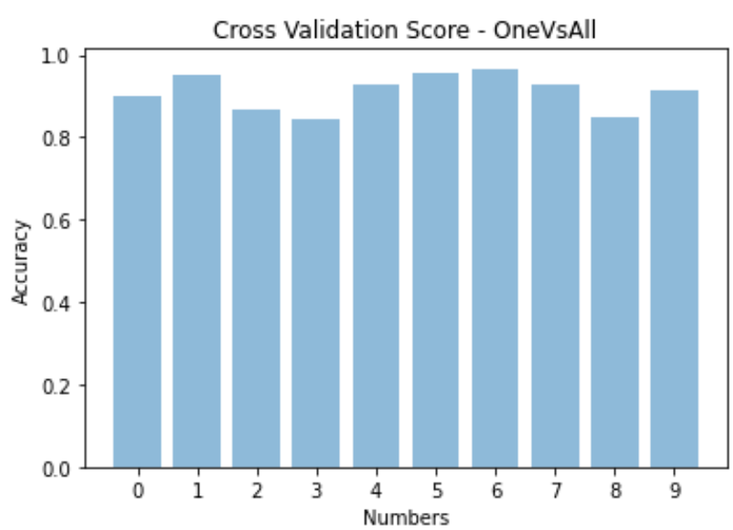

Figura 346: *Scikit-learn OneVsAll Cross Validation*

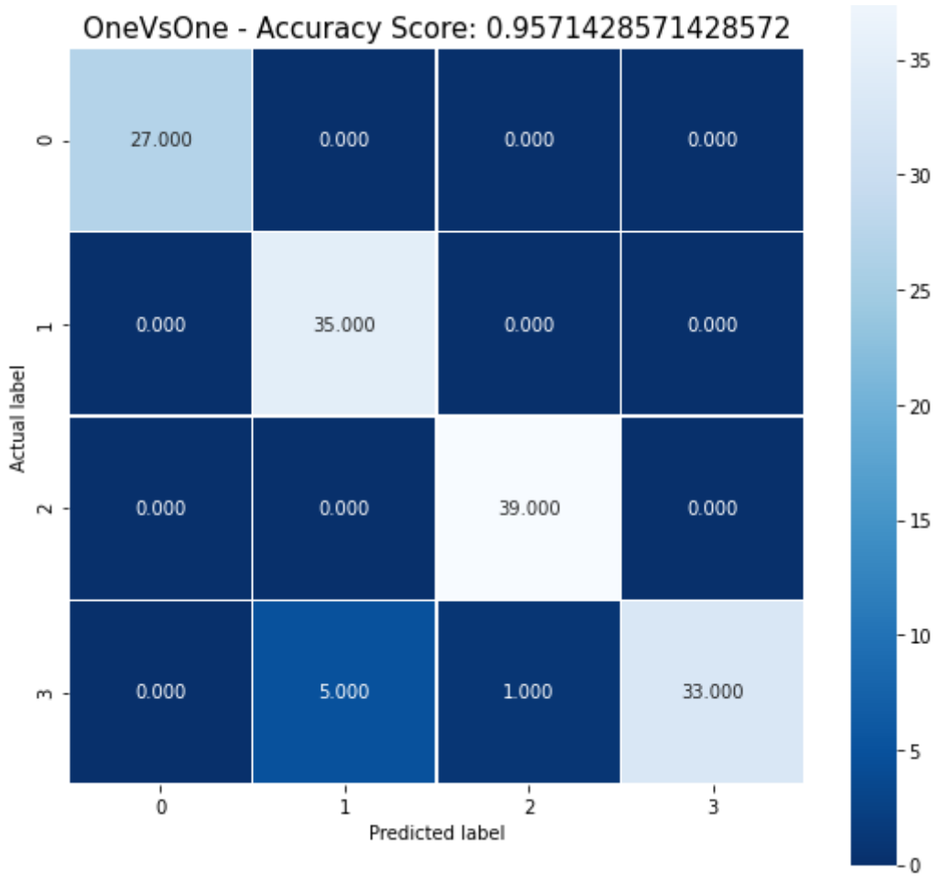

Figura 347: *Scikit-learn OneVsOne Accuracy*

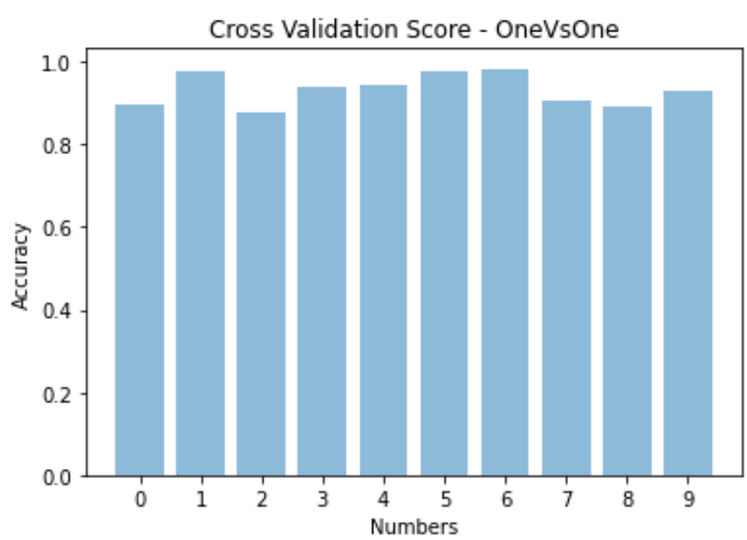

Figura 348: *Scikit-learn OneVsOne Cross Validation*

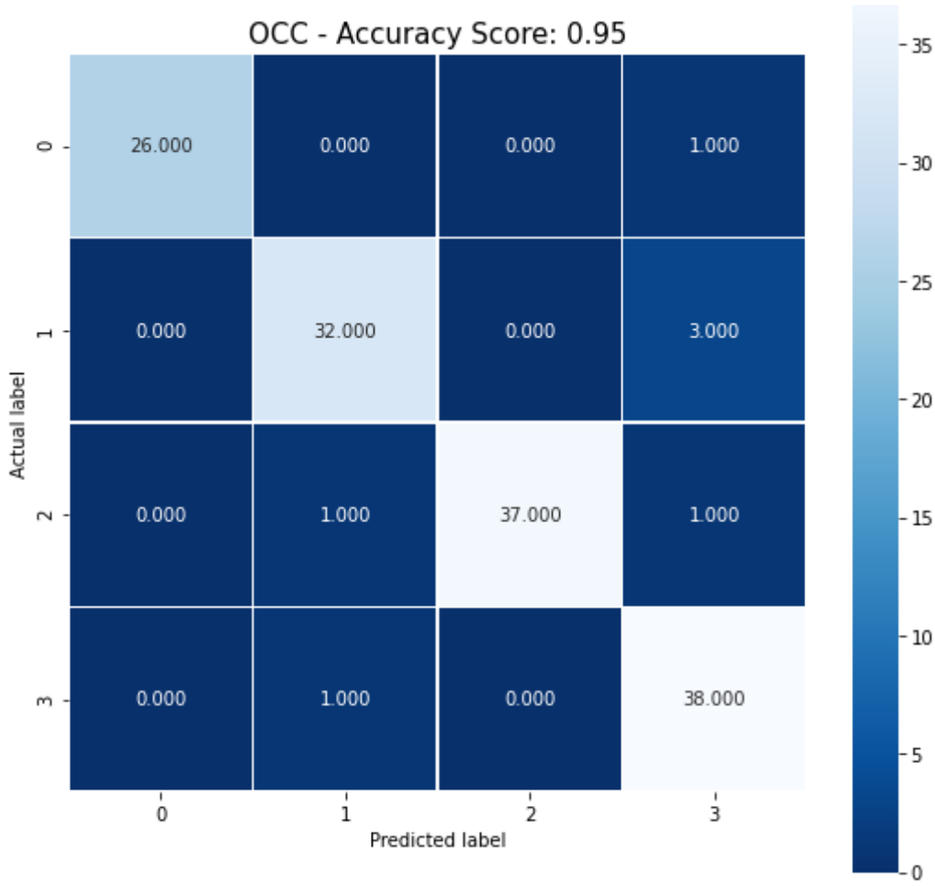

Figura 349: *Scikit-learn Error-Correcting Output Codes Accuracy*

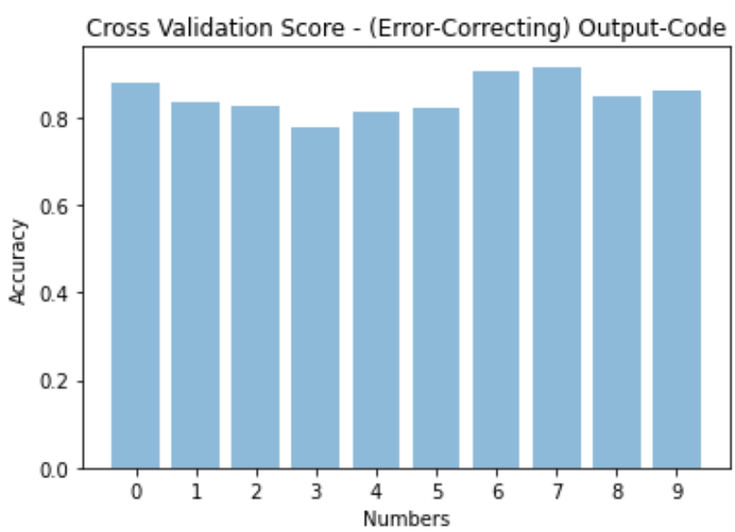

Figura 350: *Scikit-learn Error-Correcting Output Codes Cross Validation*