**MLP 64**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P = 10** | | | | **P = 30** | | | | **P = 50** | | | |
| **Dataset** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |
| **HRSS** |  | **79.87** | **67.40** | **63.40** |  | **68.54** | **62.80** | **58.21** |  | **68.07** | **61.89** | **57.03** |
| **MI-F** |  | **53.38** | **50.54** | **48.08** |  | **52.20** | **48.51** | **46.90** |  | **53.87** | **47.47** | **44.02** |
| **MI-V** |  | **74.68** | **72.98** | **73.96** |  | **68.16** | **69.22** | **66.45** |  | **66.49** | **64.56** | **62.60** |
| **OPTDIGITS** |  | **88.79** | **86.33** | **81.22** |  | **73.21** | **74.14** | **83.87** |  | **53.55** | **71.51** | **70.55** |
| **PENDIGITS** |  | **96.66** | **81.16** | **76.47** |  | **85.68** | **74.25** | **73.63** |  | **68.28** | **82.28** | **66.59** |
| **SATELLITE** |  | **69.55** | **74.51** | **84.93** |  | **66.02** | **76.69** | **81.30** |  | **61.35** | **67.53** | **76.49** |
| **SHUTTLE** |  | **96.44** | **98.85** | **99.49** |  | **79.47** | **78.40** | **89.84** |  | **68.59** | **82.60** | **83.64** |
| **THYROID** |  | **93.17** | **89.06** | **92.48** |  | **86.61** | **79.28** | **77.49** |  | **85.50** | **86.97** | **76.91** |
| **GraphMAE-THYROID** |  | **61.25** | **65.89** | **63.71** |  | **60.33** | **61.94** |  |  |  |  |  |

MLP 32

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P = 10** | | | | **P = 30** | | | | **P = 50** | | | |
| **Dataset** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |
| **HRSS** |  | **79.11** | **67.01** | **62.58** |  | **67.32** | **62.42** | **59.44** |  | **67.24** | **60.23** | **62.86** |
| **MI-F** |  | **56.56** | **50.13** | **48.16** |  | **50.56** | **48.64** | **46.94** |  | **50.27** | **51.38** | **43.18** |
| **MI-V** |  | **73.98** | **72.78** | **73.30** |  | **67.74** | **68.41** | **66.00** |  | **65.28** | **64.29** | **63.69** |
| **OPTDIGITS** |  | **90.51** | **82.19** | **78.92** |  | **70.86** | **73.20** | **81.21** |  | **63.31** | **75.59** | **64.69** |
| **PENDIGITS** |  | **96.48** | **83.08** | **77.47** |  | **85.55** | **79.08** | **76.83** |  | **69.64** | **84.03** | **70.18** |
| **SATELLITE** |  | **73.21** | **76.67** | **86.68** |  | **65.15** | **76.54** | **82.05** |  | **60.33** | **70.03** | **78.49** |
| **SHUTTLE** |  | **95.66** | **98.97** | **99.68** |  | **88.20** | **84.54** | **95.61** |  | **84.57** | **84.93** | **85.74** |
| **THYROID** |  | **91.42** | **89.46** | **92.38** |  | **87.19** | **80.16** | **81.63** |  | **84.48** | **89.14** | **76.30** |

**MLP+Feature 64**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P = 10** | | | | **P = 30** | | | | **P = 50** | | | |
| **Dataset** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |
| **HRSS** |  | **77.75** | **67.03** | **62.22** |  | **67.02** | **61.85** | **57.89** |  | **66.36** | **61.46** | **62.73** |
| **MI-F** |  | **57.66** | **51.64** | **47.61** |  | **51.85** | **51.00** | **47.20** |  | **53.01** | **47.25** | **43.70** |
| **MI-V** |  | **75.89** | **74.34** | **72.55** |  | **69.27** | **69.83** | **65.91** |  | **66.87** | **64.27** | **63.24** |
| **OPTDIGITS** |  | **95.05** | **93.19** | **81.87** |  | **78.56** | **77.17** | **81.48** |  | **62.70** | **77.26** | **69.77** |
| **PENDIGITS** |  | **96.81** | **81.96** | **70.41** |  | **85.26** | **67.47** | **74.74** |  | **66.37** | **81..78** | **70.55** |
| **SATELLITE** |  | **79.62** | **77.80** | **85.95** |  | **67.89** | **79.19** | **80.80** |  | **63.14** | **70.07** | **78.85** |
| **SHUTTLE** |  | **95.39** | **98.62** | **99.53** |  | **86.87** | **97.04** | **93.32** |  | **69.04** | **93.00** | **83.23** |
| **THYROID** |  | **89.89** | **89.95** | **92.66** |  | **85.33** | **80.86** | **80.82** |  | **84.01** | **88.78** | **68.99** |

**MLP+Feature 32**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P = 10** | | | | **P = 30** | | | | **P = 50** | | | |
| **Dataset** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |
| **HRSS** |  | **77.67** | **66.48** | **61.89** |  | **66.94** | **60.73** | **58.02** |  | **67.09** | **60.55** | **62.81** |
| **MI-F** |  | **55.69** | **51.48** | **48.04** |  | **53.28** | **51.86** | **47.33** |  | **52.44** | **49.40** | **43.58** |
| **MI-V** |  | **75.63** | **73.45** | **73.31** |  | **70.19** | **69.13** | **66.91** |  | **67.33** | **65.37** | **63.94** |
| **OPTDIGITS** |  | **95.05** | **91.91** | **80.43** |  | **78.59** | **74.75** | **83.99** |  | **63.37** | **72.82** | **69.24** |
| **PENDIGITS** |  | **96.61** | **80.43** | **69.81** |  | **85.64** | **69.44** | **66.47** |  | **69.41** | **81.17** | **61.76** |
| **SATELLITE** |  | **76.46** | **77.74** | **87.75** |  | **68.32** | **78.27** | **83.38** |  | **63.27** | **72.14** | **79.85** |
| **SHUTTLE** |  | **86.07** | **99.55** | **99.19** |  | **63.67** | **88.89** | **97.79** |  | **86.35** | **84.33** | **82.05** |
| **THYROID** |  | **91.14** | **85.11** | **94.82** |  | **86.53** | **80.00** | **80.47** |  | **84.62** | **84.60** | **65.41** |

**MLP+Feature 32 overlap**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P = 10** | | | | **P = 30** | | | | **P = 50** | | | |
| **Dataset** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |
| **HRSS** |  | **92.55** | **86.56** | **95.40** |  | **88.66** | **89.54** | **92.41** |  | **79.97** | **82.91** | **82.93** |
| **MI-F** |  | **60.56** | **56.29** | **62.55** |  | **59.46** | **57.81** | **57.51** |  | **63.43** | **60.85** | **52.77** |
| **MI-V** |  | **82.83** | **83.38** | **87.06** |  | **76.68** | **75.29** | **79.19** |  | **74.75** | **73.61** | **73.21** |
| **OPTDIGITS** |  | **99.65** | **99.91** | **100.00** |  | **81.27** | **84.62** | **77.61** |  | **65.97** | **75.95** | **86.84** |
| **PENDIGITS** |  | **99.91** | **99.58** | **100.00** |  | **71.78** | **89.06** | **90.85** |  | **42.28** | **84.16** | **83.91** |
| **SATELLITE** |  | **81.95** | **79.53** | **87.46** |  | **74.27** | **80.04** | **86.92** |  | **67.62** | **77.73** | **72.55** |
| **SHUTTLE** |  | **79.94** | **99.53** | **99.73** |  | **92.00** | **89.42** | **98.18** |  | **71.95** | **79.08** | **81.66** |
| **THYROID** |  | **83.29** | **92.65** | **97.82** |  | **87.53** | **85.89** | **93.11** |  | **83.46** | **92.31** | **90.21** |

**MLP 32 overlap**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P = 10** | | | | **P = 30** | | | | **P = 50** | | | |
| **Dataset** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |
| **HRSS** |  | **93.13** | **95.02** | **95.80** |  | **90.03** | **91.24** | **92.87** |  | **83.46** | **86.13** | **85.97** |
| **MI-F** |  | **52.87** | **53.52** | **57.38** |  | **50.70** | **51.86** | **53.87** |  | **53.37** | **52.19** | **50.12** |
| **MI-V** |  | **78.76** | **86.24** | **83.83** |  | **71.20** | **72.04** | **73.70** |  | **67.42** | **70.22** | **69.46** |
| **OPTDIGITS** |  | **97.78** | **99.74** | **99.30** |  | **73.67** | **80.39** | **85.50** |  | **54.58** | **63.64** | **71.09** |
| **PENDIGITS** |  | **99.16** | **99.90** | **100.00** |  | **72.29** | **87.98** | **91.28** |  | **42.98** | **87.15** | **91.51** |
| **SATELLITE** |  | **78.37** | **79.76** | **84.78** |  | **67.81** | **71.83** | **79.97** |  | **63.97** | **67.86** | **63.88** |
| **SHUTTLE** |  | **99.77** | **99.42** | **99.76** |  | **88.38** | **86.69** | **96.37** |  | **85.08** | **86.12** | **90.34** |
| **THYROID** |  | **90.61** | **91.92** | **95.83** |  | **86.82** | **84.59** | **94.17** |  | **83.52** | **94.08** | **91.41** |

**Balanced\_Kmeans By Oversampling 灰色表示Kmeans分群後只有一個特徵單獨一群無法oversample**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P = 10** | | | | **P = 30** | | | | **P = 50** | | | |
| **Dataset** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |
| **HRSS** |  |  |  |  |  |  |  |  |  |  |  |  |
| **MI-F** |  |  |  |  |  |  |  |  |  |  |  |  |
| **MI-V** |  |  |  |  |  |  |  |  |  |  |  |  |
| **OPTDIGITS** |  |  |  |  |  |  |  |  |  |  |  |  |
| **PENDIGITS** |  |  |  |  |  |  |  |  |  |  |  |  |
| **SATELLITE** |  |  |  |  |  |  |  |  |  |  |  |  |
| **SHUTTLE** |  |  |  |  |  |  |  |  |  |  |  |  |
| **THYROID** |  |  |  |  |  |  |  |  |  |  |  |  |

**Kmeans Without Balanced**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **P = 10** | | | | **P = 30** | | | | **P = 50** | | | |
| **Dataset** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |  | **K = 3** | **K = 6** | **K = 9** |
| **HRSS** |  |  |  |  |  |  |  |  |  |  |  |  |
| **MI-F** |  |  |  |  |  |  |  |  |  |  |  |  |
| **MI-V** |  |  |  |  |  |  |  |  |  |  |  |  |
| **OPTDIGITS** |  |  |  |  |  |  |  |  |  |  |  |  |
| **PENDIGITS** |  |  |  |  |  |  |  |  |  |  |  |  |
| **SATELLITE** |  |  |  |  |  |  |  |  |  |  |  |  |
| **SHUTTLE** |  |  |  |  |  |  |  |  |  |  |  |  |
| **THYROID** |  |  |  |  |  |  |  |  |  |  |  |  |

**Overlap : 0.1 ~ 0.9 取最大值**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **P = 10** | **K= 3** | | | | **K = 6** | | | | **K = 9** | | | |
| **Dataset** | **Origin** | **Overlap** | **Random** | **Kmeans** | **Origin** | **Overlap** | **Random** | **Kmeans** | **Origin** | **Overlap** | **Random** | **Kmeans** |
| **HRSS** | **87.13** | **92.00** | **72.86** | **72.01** | **87.13** | **93.69** | **67.43** | **63.74** | **87.13** | **93.94** | **63.57** | **62.48** |
| **MI-F** | **50.34** | **50.69** | **46.63** | **53.17** | **50.34** | **51.79** | **46.41** | **40.91** | **50.34** | **50.01** | **46.24** | **48.33** |
| **MI-V** | **77.15** | **77.66** | **70.87** | **58.32** | **77.15** | **85.70** | **69.25** | **59.61** | **77.15** | **85.38** | **68.80** | **58.47** |
| **OPTDIGITS** | **94.57** | **99.63** | **91.57** | **92.35** | **94.57** | **99.54** | **88.23** | **83.87** | **94.57** | **99.03** | **84.05** | **85.87** |
| **PENDIGITS** | **99.56** | **99.95** | **98.14** | **91.35** | **99.56** | **99.94** | **85.52** | **84.27** | **99.56** | **99.86** | **78.23** | **79.58** |
| **SATELLITE** | **51.05** | **68.73** | **72.70** | **68.78** | **51.05** | **76.33** | **84.74** | **87.63** | **51.05** | **73.95** | **95.39** | **92.06** |
| **SHUTTLE** | **39.34** | **96.93** | **99.83** | **27.95** | **39.34** | **98.49** | **93.58** | **91.90** | **39.34** | **99.53** | **98.68** | **99.43** |
| **THYROID** | **71.36** | **87.98** | **89.73** | **78.80** | **71.36** | **85.19** | **86.74** | **84.26** | **71.36** | **91.02** | **90.18** | **82.55** |
| **P = 30** | **K= 3** | | | | **K = 6** | | | | **K = 9** | | | |
| **Dataset** | **Origin** | **Overlap** | **Random** | **Kmeans** | **Origin** | **Overlap** | **Random** | **Kmeans** | **Origin** | **Overlap** | **Random** | **Kmeans** |
| **HRSS** | **78.33** | **83.78** | **68.20** | **67.27** | **78.33** | **86.85** | **64.02** | **61.21** | **78.33** | **88.82** | **58.84** | **59.64** |
| **MI-F** | **46.54** | **44.95** | **41.06** | **45.40** | **46.54** | **46.53** | **42.71** | **41.56** | **46.54** | **44.89** | **43.83** | **44.41** |
| **MI-V** | **64.10** | **67.18** | **63.21** | **65.18** | **64.10** | **70.72** | **63.82** | **62.71** | **64.10** | **71.83** | **64.31** | **65.59** |
| **OPTDIGITS** | **68.44** | **66.37** | **70.39** | **83.23** | **68.44** | **80.97** | **77.13** | **71.23** | **68.44** | **86.43** | **83.92** | **71.18** |
| **PENDIGITS** | **53.95** | **76.11** | **84.95** | **81.84** | **53.95** | **90.73** | **77.50** | **73.88** | **53.95** | **92.34** | **71.03** | **76.88** |
| **SATELLITE** | **45.64** | **63.48** | **69.49** | **59.78** | **45.64** | **67.14** | **83.59** | **85.43** | **45.64** | **64.34** | **90.47** | **88.48** |
| **SHUTTLE** | **90.22** | **86.95** | **94.55** | **94.03** | **90.22** | **87.14** | **76.23** | **93.09** | **90.22** | **93.44** | **85.12** | **98.87** |
| **THYROID** | **70.09** | **95.25** | **80.55** | **68.95** | **70.09** | **86.12** | **77.64** | **81.17** | **70.09** | **87.08** | **80.68** | **80.17** |
| **P = 50** | **K= 3** | | | | **K = 6** | | | | **K = 9** | | | |
| **Dataset** | **Origin** | **Overlap** | **Random** | **Kmeans** | **Origin** | **Overlap** | **Random** | **Kmeans** | **Origin** | **Overlap** | **Random** | **Kmeans** |
| **HRSS** | **70.10** | **81.26** | **63.72** | **62.44** | **70.10** | **83.23** | **62.66** | **61.22** | **70.10** | **83.45** | **57.24** | **57.42** |
| **MI-F** | **47.19** | **43.78** | **41.55** | **41.14** | **47.19** | **41.90** | **42.21** | **44.20** | **47.19** | **41.27** | **41.47** | **40.00** |
| **MI-V** | **59.85** | **64.64** | **58.99** | **63.58** | **59.85** | **66.68** | **61.51** | **47.32** | **59.85** | **67.43** | **61.99** | **54.26** |
| **OPTDIGITS** | **50.49** | **56.78** | **69.92** | **68.98** | **50.49** | **67.35** | **70.76** | **71.13** | **50.49** | **68.79** | **70.68** | **74.38** |
| **PENDIGITS** | **25.20** | **46.19** | **77.47** | **57.82** | **25.20** | **78.16** | **86.28** | **64.22** | **25.20** | **73.54** | **69.10** | **70.58** |
| **SATELLITE** | **49.94** | **57.39** | **62.99** | **62.47** | **49.94** | **60.39** | **80.21** | **73.69** | **49.94** | **61.83.** | **86.85** | **81.01** |
| **SHUTTLE** | **86.11** | **86.13** | **86.99** | **80.48** | **86.11** | **80.18** | **68.33** | **98.51** | **86.11** | **89.51** | **76.78** | **81.68** |
| **THYROID** | **66.38** | **79.39** | **79.62** | **72.20** | **66.38** | **85.73** | **85.14** | **81.59** | **66.38** | **89.15** | **79.25** | **76.17** |