**Erythemato-squamous disease**

**Results**

**VOTING**

**Feature Selection Phase 1**

- Chi Squared:

Features Chi-squared values

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band-like infiltrate 200.949

perifollicular parakeratosis 191.25

fibrosis of the papillary dermis 178.63

saw-tooth appearance of retes 173.459

vacuolisation and damage of basal layer 169.431

polygonal papules 168.737

melanin incontinence 156.684

follicular horn plug 151.445

follicular papules 148.462

focal hypergranulosis 146.711

oral mucosal involvement 144.632

clubbing of the rete ridges 135.131

thinning of the suprapapillary epidermis 128.573

elongation of the rete ridges 104.226

knee and elbow involvement 89.0203

scalp involvement 82.6137

spongiosis 80.1998

munro microabcess 69.2331

family history 56.3076

exocytosis 52.2424

spongiform pustule 49.0275

disappearance of the granular layer 48.8004

PNL infiltrate 46.4385

koebner phenomenon 40.1539

eosinophils in the infiltrate 34.1958

itching 24.7162

definite borders 16.8135

parakeratosis 16.1037

hyperkeratosis 14.0183

scaling 8.79327

Age 6.83847

erythema 3.96296

acanthosis 2.75767

inflammatory monoluclear inflitrate 2.20001

- Info Gain:

Features Mutual Information values

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clubbing of the rete ridges 0.635233

thinning of the suprapapillary epidermis 0.611708

elongation of the rete ridges 0.555367

band-like infiltrate 0.542035

spongiosis 0.48106

saw-tooth appearance of retes 0.477287

melanin incontinence 0.466672

fibrosis of the papillary dermis 0.458274

focal hypergranulosis 0.450043

vacuolisation and damage of basal layer 0.4368

knee and elbow involvement 0.419605

oral mucosal involvement 0.413982

polygonal papules 0.405902

exocytosis 0.38484

PNL infiltrate 0.379117

scalp involvement 0.352804

koebner phenomenon 0.317533

follicular papules 0.281818

Age 0.249444

parakeratosis 0.239063

disappearance of the granular layer 0.237365

perifollicular parakeratosis 0.230413

munro microabcess 0.223029

follicular horn plug 0.21937

definite borders 0.215768

spongiform pustule 0.186988

scaling 0.171782

erythema 0.155881

itching 0.141096

hyperkeratosis 0.104549

family history 0.103857

eosinophils in the infiltrate 0.0400867

inflammatory monoluclear inflitrate 0.021754

acanthosis 0.0214962

- Gain Ratio:

Features Gain Ratio values

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clubbing of the rete ridges 0.0871725

band-like infiltrate 0.0868783

elongation of the rete ridges 0.0855034

saw-tooth appearance of retes 0.082661

thinning of the suprapapillary epidermis 0.0824826

melanin incontinence 0.0818075

vacuolisation and damage of basal layer 0.0765025

polygonal papules 0.0702354

oral mucosal involvement 0.0699663

focal hypergranulosis 0.0697394

spongiosis 0.0672893

exocytosis 0.063241

fibrosis of the papillary dermis 0.0622297

munro microabcess 0.0612587

disappearance of the granular layer 0.0604165

knee and elbow involvement 0.0578144

follicular papules 0.0517247

scalp involvement 0.0509894

follicular horn plug 0.0497803

perifollicular parakeratosis 0.0474592

PNL infiltrate 0.0412384

definite borders 0.033384

Age 0.0331231

family history 0.0329179

koebner phenomenon 0.0318972

spongiform pustule 0.0310012

scaling 0.0265211

eosinophils in the infiltrate 0.0264154

itching 0.022409

parakeratosis 0.0193501

erythema 0.0154818

hyperkeratosis 0.0113855

acanthosis 0.00301935

inflammatory monoluclear inflitrate 0.00300894

- ReliefF:

Features ReliefF values

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clubbing of the rete ridges 0.607426

thinning of the suprapapillary epidermis 0.597234

elongation of the rete ridges 0.591681

exocytosis 0.469176

spongiosis 0.461067

band-like infiltrate 0.427227

knee and elbow involvement 0.420967

vacuolisation and damage of basal layer 0.405501

scalp involvement 0.402374

melanin incontinence 0.396907

saw-tooth appearance of retes 0.395171

polygonal papules 0.382349

focal hypergranulosis 0.374674

oral mucosal involvement 0.359982

PNL infiltrate 0.352698

munro microabcess 0.335055

koebner phenomenon 0.290922

parakeratosis 0.267688

disappearance of the granular layer 0.263268

itching 0.262587

scaling 0.243411

spongiform pustule 0.238748

definite borders 0.231492

fibrosis of the papillary dermis 0.211023

Age 0.182362

erythema 0.180466

hyperkeratosis 0.163372

inflammatory monoluclear inflitrate 0.151308

acanthosis 0.134889

family history 0.122739

eosinophils in the infiltrate 0.0807058

follicular papules 0.0731695

perifollicular parakeratosis 0.0649426

follicular horn plug 0.0540898

**Feature Selection Phase 2**

- RFE-SVM:

'band-like infiltrate',

'perifollicular parakeratosis',

'fibrosis of the papillary dermis',

'polygonal papules',

'follicular papules',

'focal hypergranulosis',

'clubbing of the rete ridges',

'thinning of the suprapapillary epidermis',

'elongation of the rete ridges',

'spongiosis',

'exocytosis',

'disappearance of the granular layer'

- Prifeb:

'band-like infiltrate',

'perifollicular parakeratosis',

'fibrosis of the papillary dermis',

'saw-tooth appearance of retes',

'vacuolisation and damage of basal layer',

'polygonal papules',

' melanin incontinence',

'follicular horn plug',

'follicular papules',

'focal hypergranulosis',

'oral mucosal involvement',

'clubbing of the rete ridges'

- Mifeb:

'clubbing of the rete ridges',

'elongation of the rete ridges',

'thinning of the suprapapillary epidermis',

' melanin incontinence',

'vacuolisation and damage of basal layer',

'spongiosis',

'oral mucosal involvement',

'band-like infiltrate',

'polygonal papules',

'focal hypergranulosis',

'saw-tooth appearance of retes'

**Final Feature Set:**

'band-like infiltrate',

'perifollicular parakeratosis',

'fibrosis of the papillary dermis',

'polygonal papules',

'follicular papules',

'focal hypergranulosis',

'clubbing of the rete ridges',

'thinning of the suprapapillary epidermis',

'elongation of the rete ridges',

'spongiosis',

'saw-tooth appearance of retes',

'vacuolisation and damage of basal layer'

**Classifiers**

SVM, KNN, MLP, Decision-Trees(C4.5), Gaussian NB & Logistic Regression

Ensemble: Bagging, Boosting, Stacking (Logistic Regression as Meta Model)

**Accuracy**

Models Accuracy values

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SVM 0.85443

DT 0.816456

MLP 0.848101

KNN 0.860759

NB 0.683544

Bag(SVM) 0.85443

Bag(DT) 0.841772

Bag(MLP) 0.860759

Bag(KNN) 0.848101

Bag(NB) 0.740506

Boost(SVM) 0.14557

Boost(DT) 0.816456

Boost(NB) 0.677215

Stacking[LogReg] 0.867089

**Precision, Recall, F1 score & Support**

Models [Precision, Recall, F1 score & Support] values

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SVM (0.8189102564102564, 0.825091575091575, 0.808841732979664, [48, 26, 31, 21, 23, 9])

DT (0.7727029914529915, 0.8183871460081138, 0.7716079795456904, [48, 26, 31, 21, 23, 9])

MLP (0.7873015873015873, 0.8156288156288156, 0.7873303167420814, [48, 26, 31, 21, 23, 9])

KNN (0.8546176046176046, 0.8513431013431013, 0.8404320987654321, [48, 26, 31, 21, 23, 9])

NB (0.5131709482038429, 0.644927536231884, 0.5276575276575276, [48, 26, 31, 21, 23, 9])

Bag(SVM) (0.8189102564102564, 0.825091575091575, 0.808841732979664, [48, 26, 31, 21, 23, 9])

Bag(DT) (0.7932748538011696, 0.8133049745952972, 0.790265822401523, [48, 26, 31, 21, 23, 9])

Bag(MLP) (0.8297619047619048, 0.8315018315018315, 0.8134920634920635, [48, 26, 31, 21, 23, 9])

Bag(KNN) (0.8099415204678363, 0.8186813186813187, 0.8041666666666667, [48, 26, 31, 21, 23, 9])

Bag(NB) (0.7890016233766234, 0.7127594627594628, 0.6500579933777246, [48, 26, 31, 21, 23, 9])

Boost(SVM) (0.024261603375527425, 0.16666666666666666, 0.0423572744014733, [48, 26, 31, 21, 23, 9])

Boost(DT) (0.7791666666666667, 0.7985458761668439, 0.7804074528485336, [48, 26, 31, 21, 23, 9])

Boost(NB) (0.512717227695676, 0.6414553140096618, 0.525224715641055, [48, 26, 31, 21, 23, 9])

Stacking[LogReg] (0.8611111111111112, 0.8577533577533577, 0.8485964104924067, [48, 26, 31, 21, 23, 9])

**Sensitivity**

Models Sensitivity values

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SVM 0.825092

DT 0.818387

MLP 0.815629

KNN 0.851343

NB 0.644928

Bag(SVM) 0.825092

Bag(DT) 0.813305

Bag(MLP) 0.831502

Bag(KNN) 0.818681

Bag(NB) 0.712759

Boost(SVM) 0.166667

Boost(DT) 0.798546

Boost(NB) 0.641455

Stacking[LogReg] 0.857753

**Specificity**

Models Specificity values

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SVM 0.97119

DT 0.965158

MLP 0.969881

KNN 0.973006

NB 0.943762

Bag(SVM) 0.97119

Bag(DT) 0.968837

Bag(MLP) 0.972407

Bag(KNN) 0.969973

Bag(NB) 0.949529

Boost(SVM) 0.833333

Boost(DT) 0.963943

Boost(NB) 0.942643

Stacking[LogReg] 0.974222