

OBJECTIVES

This paper presents a new algorithm called Feature Selection Age Layered Population Structure (FSALPS) for feature subset selection and classification of varied supervised learning tasks.

1. Canonical GP
2. ALPS[1] GP
3. FSALPS GP

FSALPS ALGORITHM

FSALPS continuously refines the feature set through a non-converging evolutionary process.

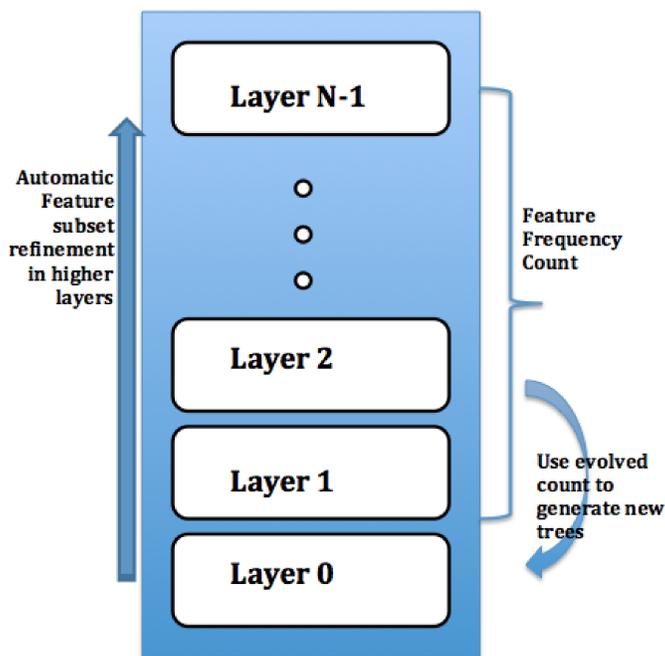


Figure 7: FSALPS Algorithm

INTRODUCTION

1. FSALPS uses a novel frequency count system to rank features in the GP population based on evolved feature frequencies.
2. The ranked features are translated into probabilities, which are used to control evolutionary processes such as terminal—symbol selection for the construction of GP trees/sub-trees.

HYPERSPECTRAL DATASET[3]



Figure 8: Sample band (2.09 μ m).

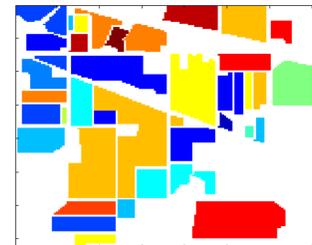


Figure 9: Ground truth of 16 classes.

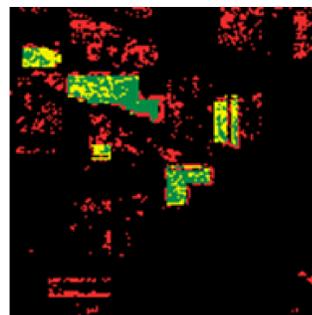


Figure 10: ALPS Classification accuracy (corn notill): 87.53%

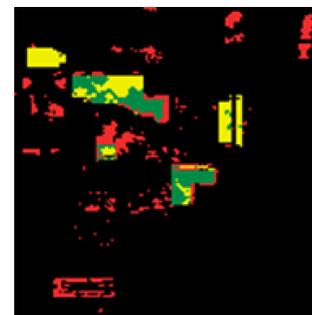


Figure 11: FSALPS Classification accuracy (corn notill): 87.57%

COMPARING ALPS[1] & FSALPS

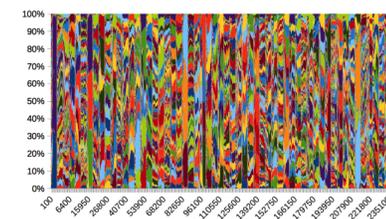


Figure 1: ALPS layer 0

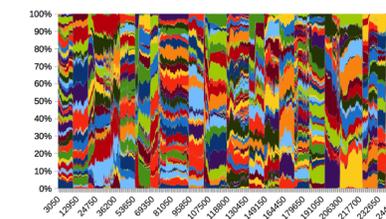


Figure 2: ALPS layer 2

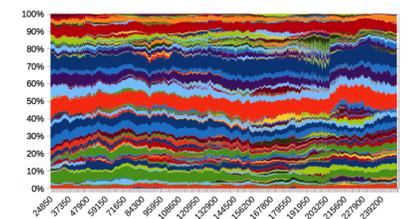


Figure 3: ALPS layer 4

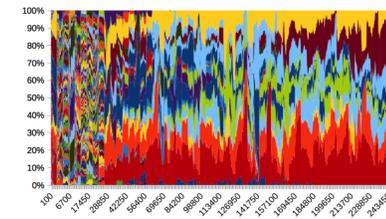


Figure 4: FSALPS layer 0

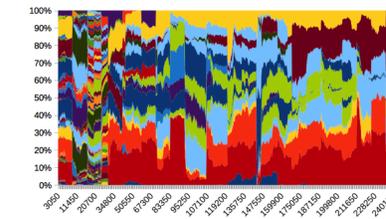


Figure 5: FSALPS layer 2

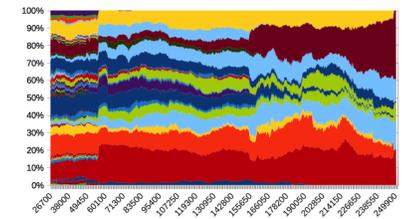


Figure 6: FSALPS layer 4

FEATURE FREQUENCY COUNTS (20 RUNS)

Dataset(Attributes)		GP	ALPS	FSALPS
Pima (9)[2]	Min	7	8	3
	Max	9	9	9
	Avg	8.6	8.9	6.4
Breast cancer (31)[2]	Min	12	6	5
	Max	26	29	17
	Avg	17.85	20.9	9.3
Ionosphere (35)[2]	Min	9	13	7
	Max	25	31	20
	Avg	18.65	23.5	12.75
Sonar (61)[2]	Min	16	28	7
	Max	42	45	27
	Avg	23.65	36.9	16.85
Corn-notill (201)[3]	Min	18	28	8
	Max	47	81	31
	Avg	30.15	51.85	18.25
Soybean-mintill (201)[3]	Min	17	29	8
	Max	49	78	40
	Avg	30.6	49.55	20.55

CONCLUSION

FSALPS results in significant feature reduction and reduced tree size, with no loss in classification accuracy.

FUTURE RESEARCH

- Feature extraction.
- Multi-classification.
- Hyperspectral: expanding GP language (e.g. filter operators).

REFERENCES

- [1] Gregory Hornby. Alps: the age-layered population structure for reducing the problem of premature convergence. In *GECCO '06*, pages 815–822. ACM, 2006.
- [2] M. Lichman. Uci machine learning repository. University of California, Irvine, School of Information and Computer Sciences, 2013.
- [3] Manuel G. Romay. Hyperspectral remote sensing scenes. University of the Basque Country, 04 2015.

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