remote sensing

MDPI

Supplementary Material

Leaf Water Potential in a Mixed Mediterranean Forest from Machine Learning and Unmanned Aerial Vehicle (UAV)-Based Hyperspectral Imaging

Netanel Fishman [1], Yehuda Yungstein [1,2], Assaf Yaakobi [3], Sophie Obersteiner [3], Laura Rez [3], Gabriel Mulero [1,2], Yaron Michael [1], Tamir Klein [3] and David Helman [1,2,*]

[1] Department of Soil and Water Sciences, Institute of Environmental Sciences, The Robert H. Smith Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot 7610001, Israel; netanel.fishman@mail.huji.ac.il (N.F.); yehuda.yungstein@mail.huji.ac.il (Y.Y.); gabriel.mulero@mail.huji.ac.il (G.M.); yaron.michael@mail.huji.ac.il (Y.M.)

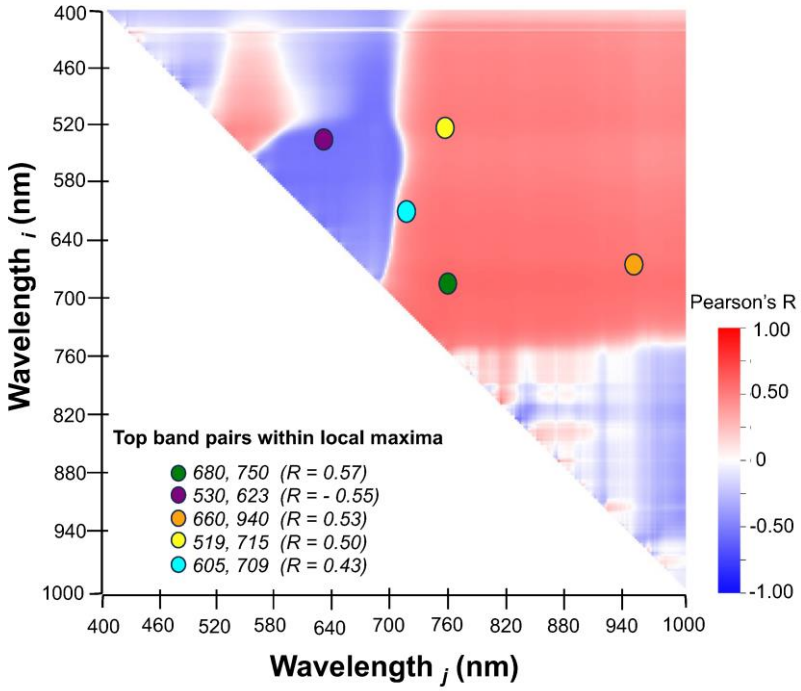
[2] The Advanced School for Environmental Studies, The Hebrew University of Jerusalem, Givat Ram, Jerusalem 9190401, Israel

[3] Department of Plant and Environmental Sciences, Weizmann Institute of Science, Rehovot 7610001, Israel; assaf.yaakobi@weizmann.ac.il (A.Y.); sophie.obersteiner@weizmann.ac.il (S.O.); laura.rez@weizmann.ac.il (L.R.); tamir.klein@weizmann.ac.il (T.K.)

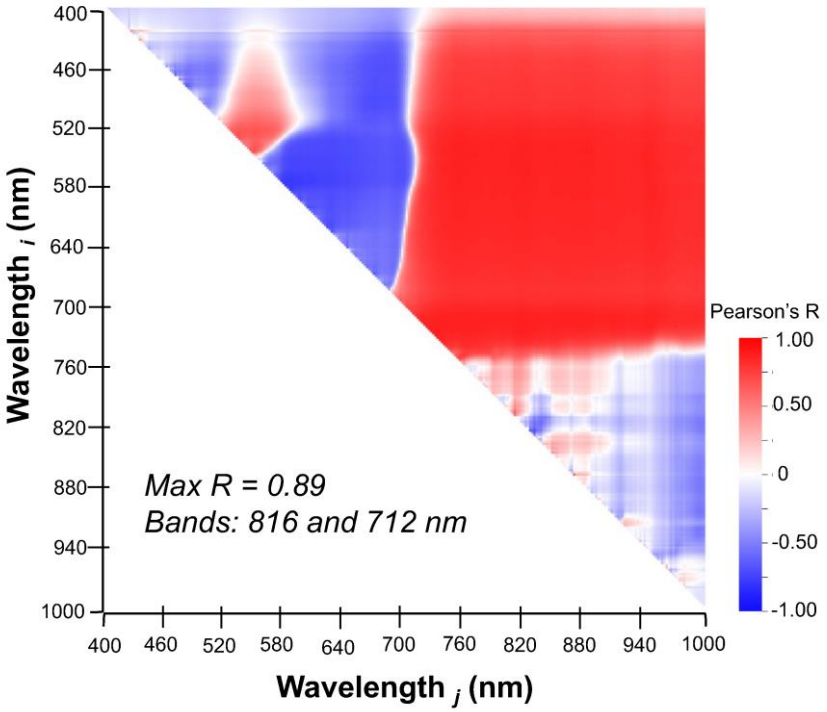
* Correspondence: david.helman@mail.huji.ac.il

Supplementary Table S1. Optimized hyperparameters for Random Forest (RF), Support Vector Machine (SVM), and XGBoost (XGB). Models implemented using scikit-learn library in Python. Models were trained on two datasets: NDSI alone and NDSI with species data.

Model	*Hyperparameter*	*NDSI*	*NDSI +Species*
RF	max_depth	30	110
	max_features	sqrt	sqrt
	min_samples_split	5	2
	n_estimators	400	1000
SVM	C	80	14
	Coef0	1.03	0.33
	degree	2	3
	epsilon	0.7	0.44
	gamma	2.04	1.22
	kernel	rbf	rbf
	tol	2.00e-04	6.84e-05
XGB	subsample	0.74	0.18
	reg_lambda	0.8	0.88
	reg_alpha	0.8	0.8
	n_estimators	1150	1150
	min_child_weight	2	2
	max_depth	4	3
	learning_rate	0.01	0.01
	colsample_bytree	0.9	0.99



Supplementary Figure S1. Correlation maps of all possible two-band combinations with normalized difference vegetation index (NDSI) and the measured ψ_{leaf} (N = 246). Five points on the map represent local maxima with their corresponding Pearson's R-value ($p < 0.001$).



Supplementary Figure S2. Correlation maps of all possible two-band combinations with normalized difference vegetation index (NDSI) and the measured ψ_{leaf} averaged over the entire plot (N = 56). The best-performing two-band NDSI combinations are based on the maximum Pearson's R-value ($p < 0.001$).