Supporting Information

Using Convolutional Neural Networks to Predict Composite Properties beyond the Elastic Limit

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Supplemental table

Table SI. Material properties of hard and soft blocks used in crack phase field simulations.

	Young's modulus (MPa)	Poisson's ratio	Critical energy release rate (kJ/m^2)	Length scale parameter (m)
Soft material	21	0.3	0.00005	0.1666
Hard material	2100	0.3	0.00005	0.1666

Supplemental figures

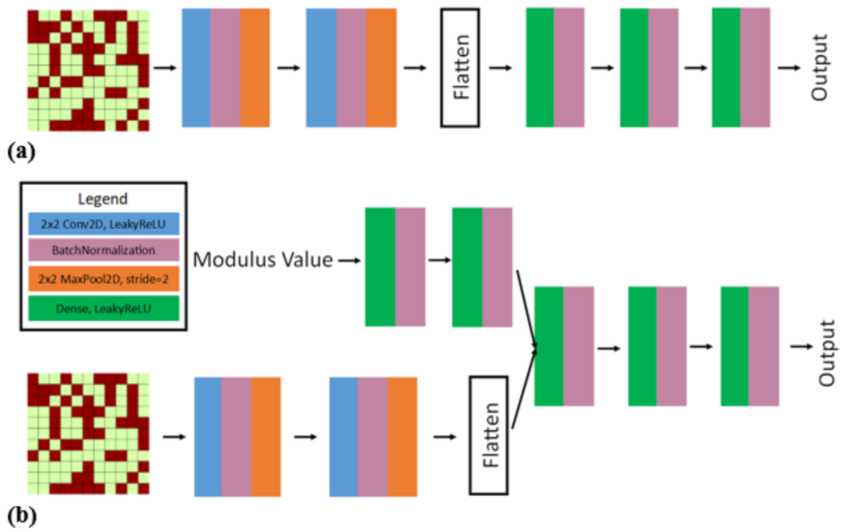

Figure S1: Convolutional neural network architecture's using a) only unit cell geometry as input and b) using unit cell geometry and associated modulus value as inputs.

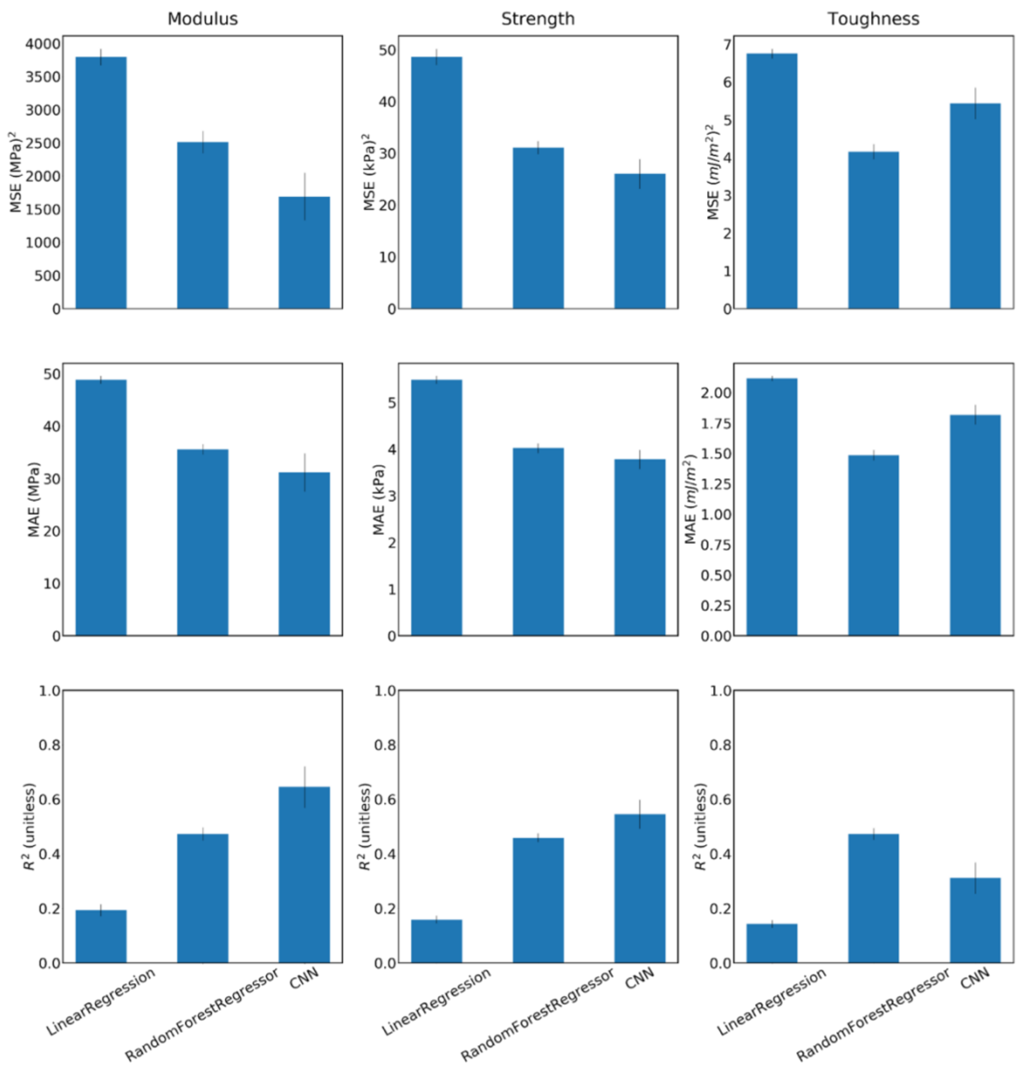

Figure S2: Bar plot of OLS, RF, and CNN performance as measured by MSE, MAE, and R^2. 95% Confidence intervals are shown.

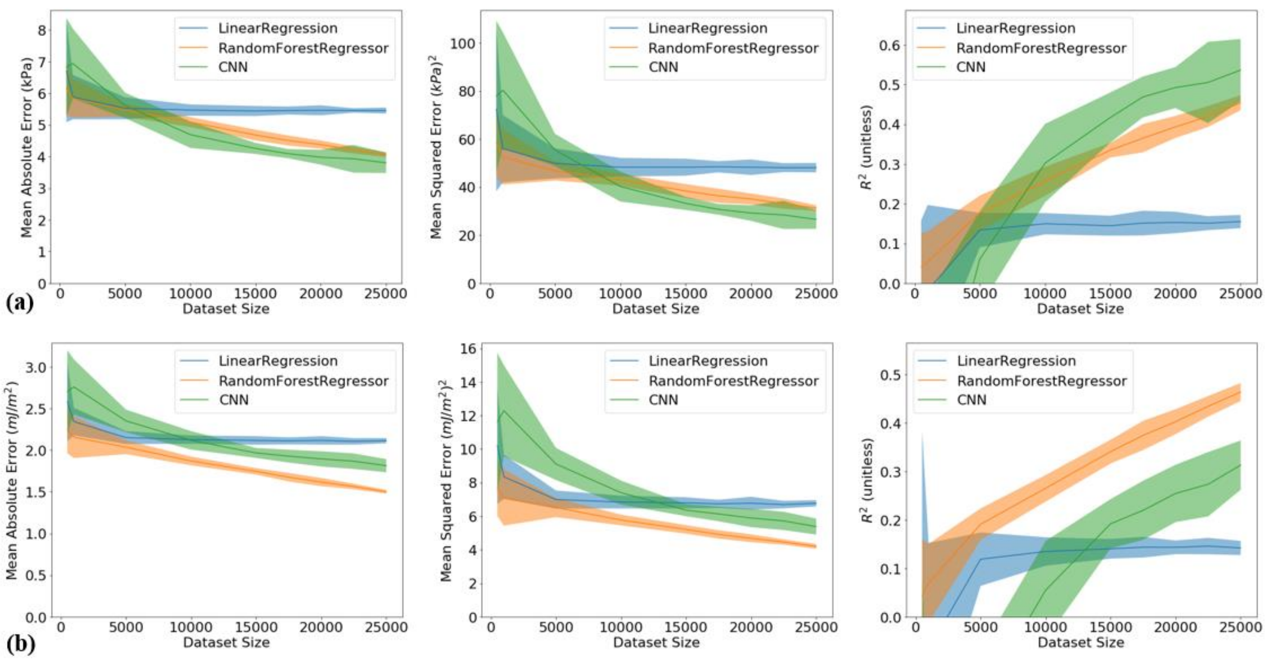

Figure S3: The effect of dataset size on the performance of various models as measured by MAE, MSE, R^2 at predicting a) strength and b) toughness. The given dataset sizes are then fed into the models with an 80/20 train/test split. 95% confidence intervals are shown.

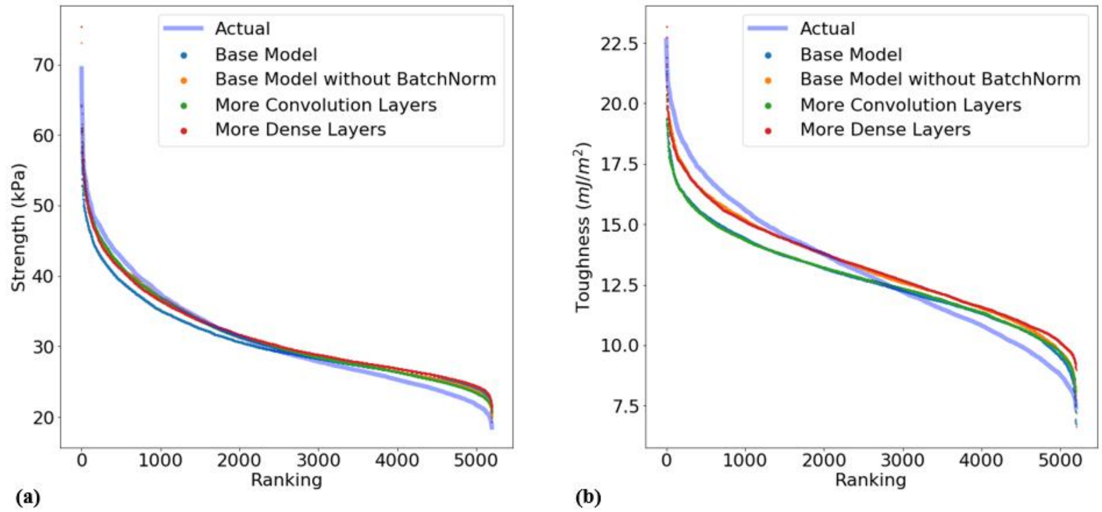

Figure S4: The ranking curves as predicted by different CNN architectures for a) strength and b) toughness. "Base Model" is the overall CNN architecture used against RF and OLS. "Base Model without BatchNorm" is the Base Model but with all Batch Normalization layers removed. "More Convolution Layers" is the Base Model without max pooling layers and an extra Conv2D layer. "More Dense Layers" is the Base Model but with an extra dense layer at the end. Slight alterations were made to kernel and pool size to keep similar number of parameters for all models.