Supplementary Material

1 SUPPLEMENTARY TABLES AND FIGURES

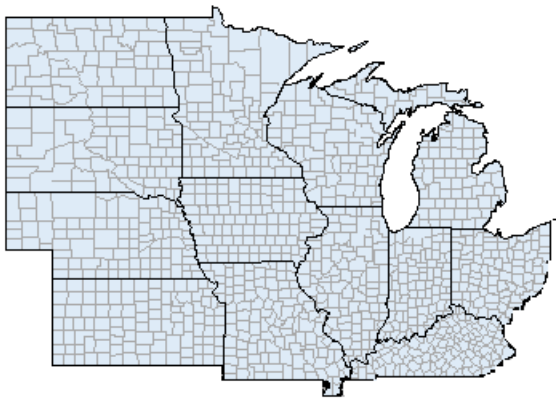

Figure S1: Map of the Corn Belt in the United States.

Summary statistics	Corn	Soybean
Total number of locations	1,176	1,115
Year range	1980-2018	1980-2018
Mean yield	120.71	38.22
Standard deviation of yield	38.13	10.47
First quartile of yield	94.3	31.0
Median yield	121.0	38.0
Third quartile of yield	147.0	45.5
Minimum yield	11.0	6.0
Maximum yield	246.7	82.3
Number of weather components	6	6
Number of soil components	14	14
Number of management components	1	1
Number of observations	41,070	36,277

Table S1: Summary statistics of the data over all years. The unit of yield is bushels per acre

W-CNN structure				
Input size	52×1			
Layer name	FS	NF	S	P
Conv1	9	8	1	valid
Average pooling 1	2	-	2	valid
Conv2	3	12	1	valid
Average pooling 2	2	-	2	valid
Conv3	3	16	1	valid
Average pooling 2	2	-	2	valid
Conv3	3	20	1	valid
Average pooling 2	2	-	2	valid
Output size	20×1			

S-CNN structure				
Input size	10×1			
Layer name	FS	NF	S	P
Conv1	3	4	1	valid
Average pooling 1	2	-	2	valid
Conv2	3	8	1	valid
Average pooling 2	2	-	2	valid
Conv3	2	12	1	valid
Output size	12×1			

Table S2: The left and the right tables show the detailed stucture of the W-CNN and S-CNN, respectively. FS, NF, S, and P stand for filter size, number of filter, stride, and padding, respectively.

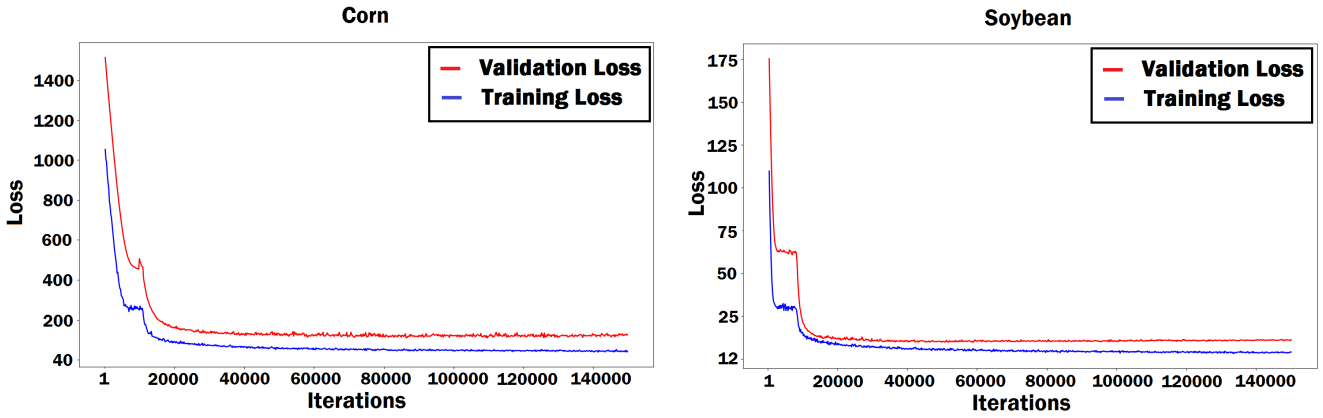

Figure S2: The left and right plots show the plots of the training loss and validation loss for corn and soybean yield predictions of the year 2018, respectively. We used Huber loss which combines both squared loss and absolute loss.

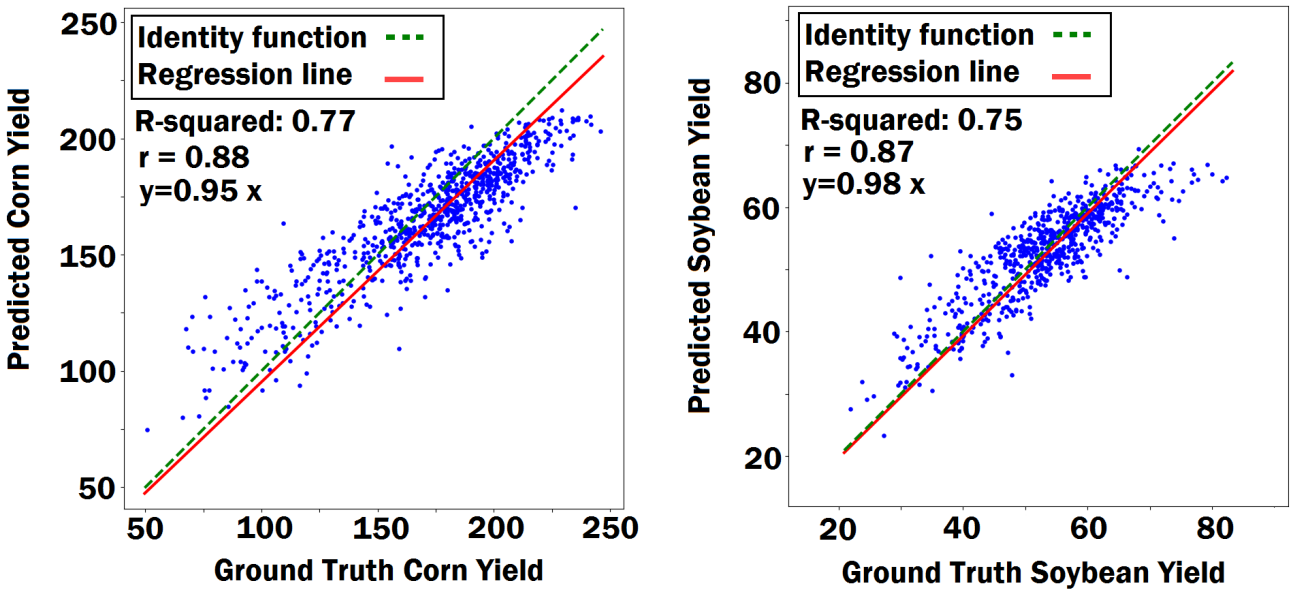

Figure S3: The left and right plots show the plots of the ground truth yield versus the predicted yield for corn and soybean yield predictions of the year 2018, respectively. The unit of yield is bushels per acre.

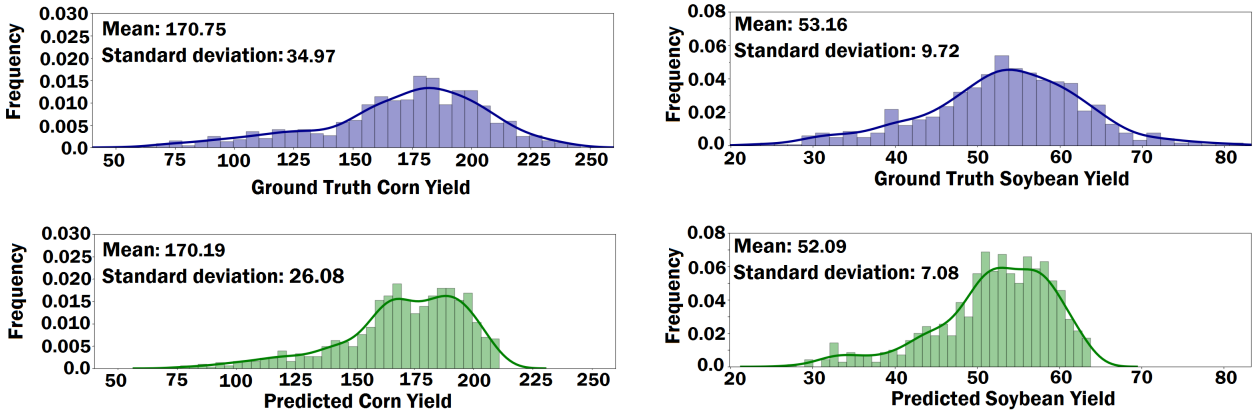

Figure S4: The left and right plots show the probability density functions of the ground truth yield and the predicted yield for corn and soybean yield predictions of the year 2018, respectively. The plots indicate that CNN-RNN model can approximately preserve some of the distributional properties of the ground truth yield. The unit of yield is bushels per acre.

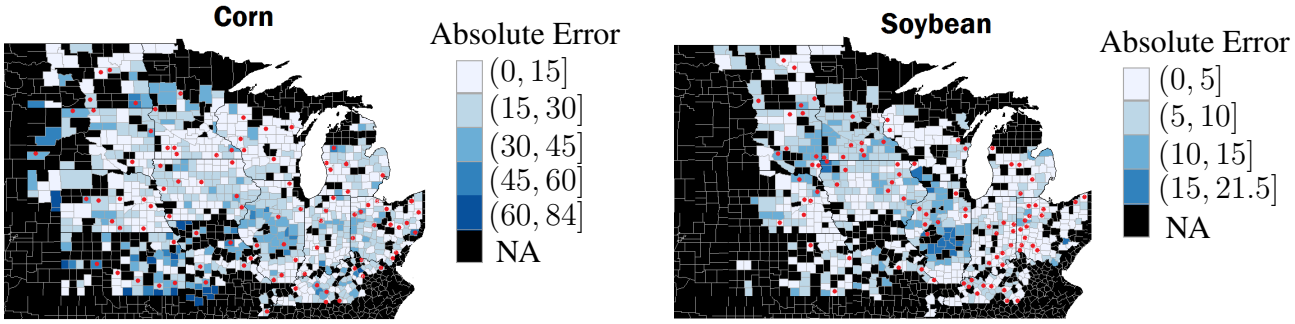

Figure S5: The left and right maps show the absolute prediction errors of the year 2018 for corn and soybean yield predictions, respectively. Counties with red dots indicate the untested counties. The counties in black color inside the cornbelt indicate that ground truth yields were not available for these counties for the year 2018. The unit of error is bushels per acre.