Supplementary Material: A Fast 3D CNN for Hyperspectral Image Classification

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The per-class experimental evaluations for PUD, SD, SAD and IPD with different number of spatial dimensions is provided in the following Figures. The number of training and test samples are also provided in their respective class column/rows.

Pavia University Dataset (PUD)

Pavia University Dataset (PUD) gathered over Pavia in northern Italy using a Reflective Optics System Imaging Spectrometer (ROSIS) optical sensor. PUD consists of 610×610 spatial and 103 spectral bands with a spatial resolution of 1.3 meters. PUD ground truth classes are 9.

(a) 11×11 (b) 15×15 (c) 19×19

Figure 1: **Pavia University Dataset (PUD)** Confusion Matrices with per class accuracy for 3 different spatial dimensions (i.e., 11×11, 15×15 and 21×21 processed through our proposed model.

0.1 Salinas Dataset (SD)

The Salinas Dataset (SD) was acquired over Salinas Valley California using AVIRIS sensor. SD is of size $512 \times 217 \times 224$ with a 3.7 meter spatial resolution with 512×217 is spatial and 224 spectral dimensions. SD consists of vineyard fields, vegetables and bare soils. SD consist of 16 classes. A few water absorption bands $108 - 112, 154 - 167$ and 224 are removed before analysis.

0.2 Indian Pines Dataset (IPD)

Indian Pines Dataset (IPD) is obtained over northwestern Indiana's test site by Airborne Visible / Infrared Imaging Spectrometer (AVIRIS) sensor. IPD is of size $145 \times 145 \times 224$ in the wavelength range $0.4 - 2.5 \times 10^{-6}$ meters where

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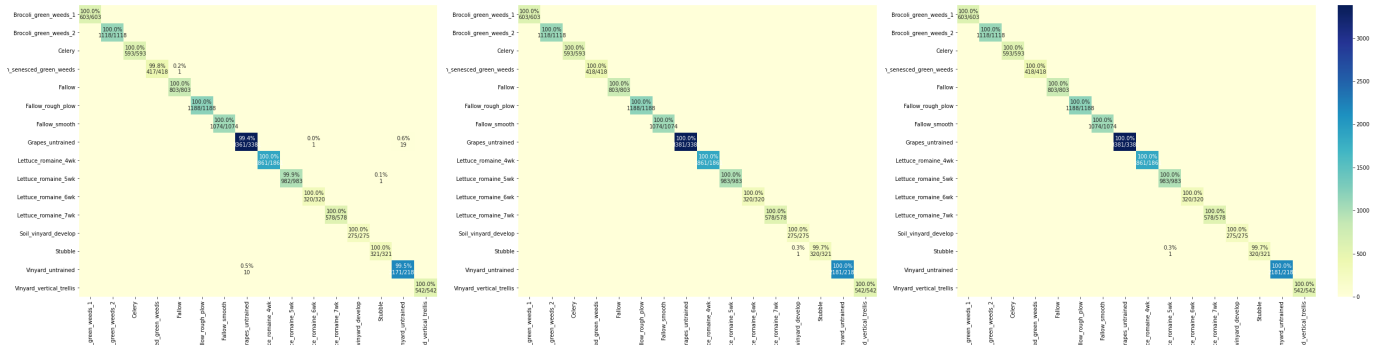
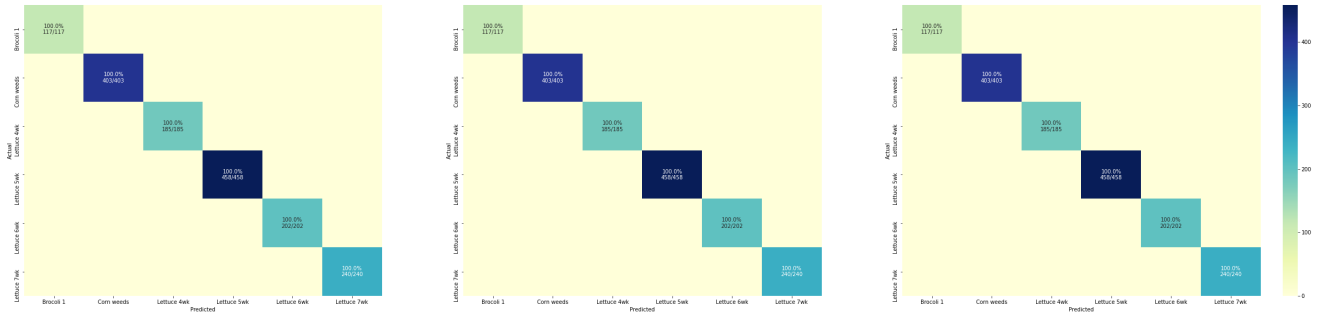


(a) 11×11 (b) 15×15 (c) 21×21

Figure 2: **Salinas Dataset** Confusion Matrices with per class accuracy for 3 different spatial dimensions (i.e., 11×11, 15×15 and 21×21 processed through our proposed model.



(a) 11×11 (b) 15×15 (c) 21×21

Figure 3: **Salinas-A Dataset** Confusion Matrices with per class accuracy for 3 different spatial dimensions (i.e., 11×11, 15×15 and 21×21 processed through our proposed model.

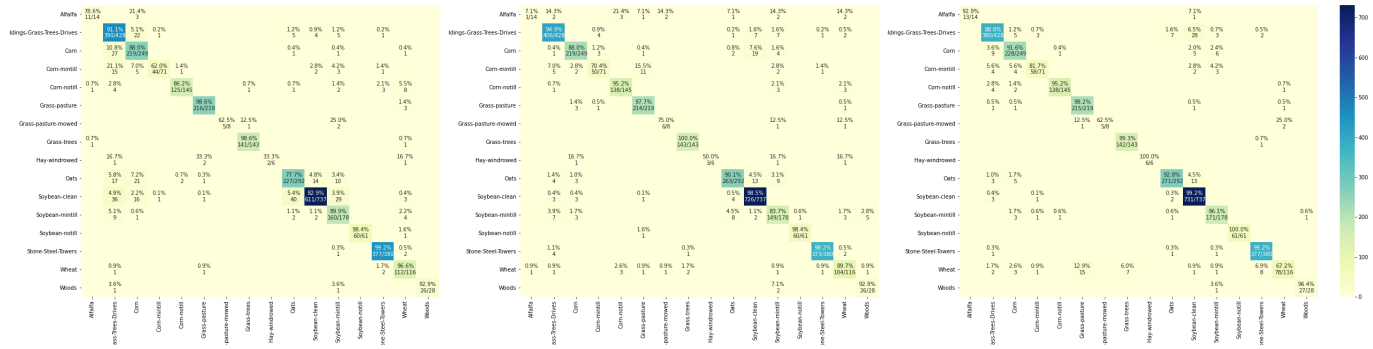
145×145 is the spatial and 224 spectral dimensions. IPD consists of 1/3 forest and 2/3 agriculture area and other naturally evergreen vegetation. Some corps in the early stages of their growth is also present with approximately less than 5% of total coverage. Low-density housing, building and small roads, Two dual-lane highway and a railway line are also a part of IPD. The IPD ground truth comprised of 16 classes which are not mutually exclusive. The water absorption bands have been removed before the experiments thus the remaining 200 bands are used in this experiment.

0.3 Statistical Measures

For experimental evaluation, several tests have been conducted including but not limited to F1-Score, Precision, and Recall rate. All these evaluation metrics are calculated using the following mathematical formulations.

$$Precision = \frac{1}{C} \sum_{i=1}^{C} \frac{TP_i}{TP_i + FP_i} \tag{1}$$

$$Recall = \frac{1}{C} \sum_{i=1}^{C} \frac{TP_i}{TP_i + FN_i} \tag{2}$$



(a) 11×11 (b) 15×15 (c) 21×21

Figure 4: **Indian Pines Dataset** Confusion Matrices with per class accuracy for 3 different spatial dimensions (i.e., 11×11, 15×15 and 21×21 processed through our proposed model.

$$F1 - Score = \frac{2 \times (Recall \times Precision)}{(Recall + Precision)} \tag{3}$$

where TP and FP are true and false positive, TN and FN are true and false negative computed from the confusion matrix. The class-wise analysis of these statistical observations is provided in the Tables 3-2.

Table 1: Class-wise Statistical Analysis for **Salinas dataset**

Class Name	**Precision**	**Recall**	**F1-score**	**Sample**
Brocoli_green_weeds_1	1.00	1.00	1.00	603
Brocoli_green_weeds_2	1.00	1.00	1.00	1118
Fallow	1.00	1.00	1.00	593
Fallow_rough_plow	1.00	1.00	1.00	418
Fallow_smooth	1.00	1.00	1.00	803
Stubble	1.00	1.00	1.00	1188
Celery	1.00	1.00	1.00	1074
Grapes_untrained	1.00	1.00	1.00	3381
Soil_vinyard_develop	1.00	1.00	1.00	1861
Corn_senesced_green_weeds	1.00	1.00	1.00	983
Lettuce_romaine_4wk	1.00	1.00	1.00	320
Lettuce_romaine_5wk	1.00	1.00	1.00	578
Lettuce_romaine_6wk	1.00	1.00	1.00	275
Lettuce_romaine_7wk	1.00	1.00	1.00	321
Vinyard_untrained	1.00	1.00	1.00	2181
Vinyard_vertical$_t rellis$	1.00	1.00	1.00	542

Table 2: Class-wise Statistical Analysis for **Salinas-A dataset**

Class Name	**Precision**	**Recall**	**F1-score**	**Sample**
Corn weeds	1.00	1.00	1.00	403
Lettuce 4wk	1.00	1.00	1.00	185
Lettuce 5wk	1.00	1.00	1.00	458
Lettuce 6wk	1.00	1.00	1.00	202
Lettuce 7wk	1.00	1.00	1.00	240

Table 3: Class-wise Statistical Analysis for **Pavia University dataset**

Class Name	**Precision**	**Recall**	**F1-score**	**Sample**
Asphalt	1.00	1.00	1.00	1989
Meadows	1.00	1.00	1.00	5595
Gravel	0.98	1.00	0.99	630
Trees	1.00	1.00	1.00	919
Painted metal sheets	1.00	1.00	1.00	403
Bare Soil	1.00	1.00	1.00	1509
Bitumen	0.99	1.00	0.99	399
Self-Blocking Bricks	1.00	0.99	0.99	1105
Shadows	1.00	0.96	0.98	284

Table 4: Class-wise Statistical Analysis for **Indian Pines dataset**

Class Name	**Precision**	**Recall**	**F1-score**	**Sample**
Alfalfa	1.00	0.93	0.96	14
Corn-notill	0.93	0.89	0.91	428
Corn-mintill	0.91	0.92	0.91	249
Corn	0.91	0.82	0.86	71
Grass-pasture	0.99	0.95	0.97	145
Grass-trees	0.93	0.98	0.96	219
Grass-pasture-mowed	1.00	0.62	0.77	8
Hay-windrowed	0.95	0.99	0.97	143
Oats	1.00	1.00	1.00	6
Soybean-notill	0.96	0.93	0.94	292
Soybean-mintill	0.93	0.99	0.96	737
Soybean-clean	0.92	0.96	0.94	178
Wheat	1.00	1.00	1.00	61
Woods	0.97	0.99	0.98	380
Buildings-Grass-Trees-Drives	0.95	0.67	0.79	116
Stone-Steel-Towers	0.96	0.96	0.96	28