**Table 1.** Original PSB.SD bands and derived spectral and textural features with equations, where applicable. Bold indicates features retained for image classification after correlation testing.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Abbrev.** | **Band center / Equation** | **Reference** |
| Band 1 - coastal\_blue | b1 | 443 nm | Planet Labs Inc., 2023 |
| Band 2 - blue | b2 | 490 nm | Planet Labs Inc., 2023 |
| Band 3 - green edge | b3 | 531 nm | Planet Labs Inc., 2023 |
| Band 4 - green | b4 | 565 nm | Planet Labs Inc., 2023 |
| Band 5 - yellow | b5 | 610 nm | Planet Labs Inc., 2023 |
| Band 6 - red | b6 | 665 nm | Planet Labs Inc., 2023 |
| Band 7 - red-edge | b7 | 705 nm | Planet Labs Inc., 2023 |
| **Band 8 - near-infrared** | **b8** | **865 nm** | Planet Labs Inc., 2023 |
| Visible-Red NIR Built Index | VrNIRBI | (b6 - b8) / (b6 + b8) | Javed et al., 2021 |
| Visible-Green NIR Built Index | VgNIRBI | (b3 - b8) / (b3 + b8) | Javed et al., 2022 |
| **Normalized Difference Built Index Blue-Green** | **NDBIbg** | **(b2 - b4) / (b2 + b4)** | Javed et al., 2023 |
| **Normalized Difference Built Index Red-Green** | **NDBIrg** | **(b6 - b4) / (b6 + b4)** | Javed et al., 2024 |
| Normalized Difference Red-edge Index | NDRE | (b8 - b7) / (b8 + b7) | Evangelides and Nobajas, 2020 |
| **Normalized Difference Impervious Surface Index** | **NISI** | **((b2 + b3 + b6) - b8) / ((b2 + b3 + b6) + b8)** | Su et al., 2022 |
| **Impervious Surface Texture 5x5** | **NISI5x5** | **sd(NISI)** | Farwell et al., 2021 |
| Impervious Surface Texture 12x12 | NISI12x12 | sd(NISI) | Farwell et al., 2021 |
| Impervious Surface Texture 27x27 | NISI27x27 | sd(NISI) | Farwell et al., 2021 |
| **Minimum Noise Fraction (MNF)** | **MNF1** | **see reference** | Green et al. 1988 |

**Table 2.** Accuracy metrics of the best ResNet-18 and XGBoost models including precision, recall, F1-score, and holdout support (20% of class distribution). Best class F1-score achieved in either area of interest (AOI) are in bold. n/a indicates material that was listed in a certain AOI.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | **Washington, D.C.** | | | |  | **Denver, Colorado** | | | | |
|  | *Code* | *Desc.* |  | *Precision* | *Recall* | *F1* | *N****†*** |  | *Precision* | *Recall* | | *F1* | *N****†*** |
| **ResNet-18** | AP | Asphalt |  | n/a | n/a | n/a | n/a |  | **0.77** | | **0.93** | **0.85** | **1624** |
| CN | Concrete |  | n/a | n/a | n/a | n/a |  | **0.70** | | **0.87** | **0.78** | **552** |
| CS | Composition shingle |  | 0.80 | 0.63 | 0.70 | 7427 |  | **0.97** | | **0.93** | **0.95** | **17313** |
| ME | Metal |  | **0.88** | **0.75** | **0.81** | **7373** |  | n/a | | n/a | n/a | n/a |
| SH | Shingle |  | **0.11** | **0.26** | **0.15** | **157** |  | n/a | | n/a | n/a | n/a |
| SL | Slate |  | **0.48** | **0.67** | **0.56** | **3054** |  | 0.00 | | 0.00 | 0.00 | 46 |
| TG | Tar and gravel |  | n/a | n/a | n/a | n/a |  | **0.13** | | **0.41** | **0.20** | **46** |
| TL | Tile |  | 0.24 | 0.36 | 0.29 | 185 |  | **0.59** | | **0.74** | **0.66** | **569** |
| UR | Urethane |  | **0.14** | **0.61** | **0.23** | **256** |  | n/a | | n/a | n/a | n/a |
| WS | Wood shake / shingle |  | 0.15 | 0.37 | 0.21 | 231 |  | **0.62** | | **0.65** | **0.64** | **2129** |
|  | *Average****\**** | | | ***0.70*** | | | |  | ***0.89*** | | | | |
| **XGBoost** | AP | Asphalt |  | n/a | n/a | n/a | n/a |  | 0.80 | | 0.47 | 0.60 | 1624 |
| CN | Concrete |  | n/a | n/a | n/a | n/a |  | 0.30 | | 0.19 | 0.23 | 552 |
| CS | Composition shingle |  | 0.71 | 0.53 | 0.61 | 7427 |  | 0.83 | | 0.95 | 0.89 | 17313 |
| ME | Metal |  | 0.80 | 0.70 | 0.75 | 7373 |  | n/a | | n/a | n/a | n/a |
| SH | Shingle |  | 0.04 | 0.03 | 0.03 | 157 |  | n/a | | n/a | n/a | n/a |
| SL | Slate |  | 0.37 | 0.56 | 0.45 | 3054 |  | 0.00 | | 0.00 | 0.00 | 46 |
| TG | Tar and gravel |  | n/a | n/a | n/a | n/a |  | 0.04 | | 0.35 | 0.08 | 46 |
| TL | Tile |  | 0.17 | 0.26 | 0.21 | 185 |  | 0.36 | | 0.12 | 0.18 | 569 |
| UR | Urethane |  | 0.06 | 0.28 | 0.10 | 256 |  | n/a | | n/a | n/a | n/a |
| WS | Wood shake / shingle |  | 0.03 | 0.09 | 0.05 | 231 |  | 0.44 | | 0.12 | 0.19 | 2129 |
|  | *Average****\**** | | | *0.61* | | | |  | *0.76* | | | | |
| \* Weighted F1-score across materials  †N denotes the validation support | | | | | | | | | | | | | |

**Table S1.** Microsoft Building Footprints distribution of area (m2) and nearest neighbor distance by region and material type.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Material** | **Region** | **Mean Area (m2)** | **90th Percentile Area (m2)** | **Mean Side Length (m)** | **90th Percentile Side Length (m)** | **Nearest Neighbor Distance (m)** |
| AP | Denver | 220.3 | 334.7 | 15.4 | 21.9 | 26.6 |
| CN | Denver | 379.3 | 590.0 | 21.2 | 34.8 | 44.5 |
| CS | DC | 95.6 | 166.2 | 9.8 | 17.8 | 14.2 |
| CS | Denver | 173.9 | 255.9 | 13.6 | 20.2 | 20.5 |
| ME | DC | 82.7 | 116.7 | 10.0 | 19.9 | 8.8 |
| SH | DC | 104.7 | 182.1 | 10.6 | 19.0 | 71.4 |
| SL | DC | 107.9 | 184.2 | 10.6 | 19.0 | 18.8 |
| SL | Denver | 542.7 | 1027.9 | 27.1 | 54.1 | 214.8 |
| TG | Denver | 498.9 | 825.0 | 22.8 | 49.1 | 175.9 |
| TL | DC | 126.2 | 222.3 | 11.5 | 20.6 | 48.9 |
| TL | Denver | 261.4 | 440.4 | 16.5 | 26.7 | 63.6 |
| UR | DC | 87.1 | 117.2 | 10.5 | 20.8 | 29.0 |
| WS | DC | 109.3 | 212.3 | 10.6 | 19.0 | 50.9 |
| WS | Denver | 250.8 | 393.9 | 16.7 | 27.5 | 44.6 |
| **Average** | Denver | 332.5 | 552.5 | 19.0 | 33.5 | 84.4 |
| **Average** | DC | 101.9 | 171.6 | 10.5 | 19.4 | 34.6 |