**Supplementary methods**

The stained slides were scanned using Leica’s Aperio AT2 slide scanner. The digital images were analyzed with a convolutional neural network (U-Net) to detect individual cells (regardless of tumor or non-tumor cells) in each tissue spot as previously described (1). A three-step approach was then applied to determine the fraction of PD-L1 positive cells in each tissue spot. First, a threshold for positive staining was manually set for each antibody that resulted in clearly visible membranous tumor cell staining. Second, cells with non-specific background staining that could lead to false positive cell counting were identified with a recently developed DeepLab learning system (2) and labeled as negative for PD-L1. In the last step, numbers of PD-L1 positive and PD-L1 negative cells were counted in each tissue spot and the fraction (%) of PD-L1 positive cells was calculated.

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|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Supplementary Table 1: Anti-PD-L1 antibodies and staining protocols** | | | | | | | | | |
|  |  |  |  |  |  |  |  |  |
| **Target protein** | **Antibody vendor** | **Clone** | **Host species** | **Catalogue no.** | **Antigen retrieval  pH value** | **Dilution** | **Stainer** | **Detection** |
| PD-L1 | MS Validated Antibodies | MSVA- | rabbit | 2083-711R | 9.0 | 1:150 | manual | Dako EnVision Kit |
| PD-L1 | Cell Signaling Technologies | E1L3N | rabbit | #13684 | 9.0 | 1:200 | Leica Bond RX | Bond refined detection kit |
| PD-L1 | Roche | SP142 | rabbit | 741-4860 | 9.0 | RTU | Ventana Discovery ultra | OptiView kit |
| PD-L1 | Roche | SP263 | rabbit | 741-4905 | 9.0 | RTU | Ventana Discovery ultra | OptiView kit |

(1-250)(251-385)(386-548)

Supplementary Table 2: Literature used to build Figure 4.

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