Supplementary table 1: Immune metagenes

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| Inhibitory immune checkpoint genes | CD276, VTCN1, BTLA, CTLA4, LAG3, CD274, C10orf54, TNFRSF14, PDCD1LG2, ADORA2A, PDCD1, IDO1, HAVCR2, LAIR1, LGALS9, PVRL3, TIGIT |
| Stimulatory immune checkpoint genes | CD2, CD226, CD27, CD28, CD40, CD40LG, CD58, CD70, CD86, ICOS, ICOSLG, SLAMF1, TNFRSF18, TNFRSF25, TNFRFS4, TNFRFS8, TNFRFS9, TNFSF14, TNFSF15, TNFSF18, TNFSF4, TNFSF8, TNFSF9 |
| T-cell activation genes | CCL2, CCL3, PTPRC, ICOS, GZMK, CXCL10, CXCL9, CCL4, CD8A, IRF1, HLA-DMA, HLA-DMB, HLA-DRA, HLA-DOA, HLA-DRB1, HLA-DOB |
| T-cell cytolytic activity | GZMA, PRF1 |
| Macrophage activity | ITGAM, ADGRE1, CD68, CSF1R, LGALS3, ITGAX, IL4R, CD163 |
| Natural killer cells | KLRF1, KLRC1, KLRD1 |
| Lymphocyte-specific protein tyrosine kinase genes | ARHGAP15, ARHGAP25, CCL5, CCR2,CCR7, CD2, CD247, CD27, CD3D, CD48, CD53, CORO1A, CSF2RB, EVI2B, FGL2, GIMAP4, GIMAP5, GMFG, GZMA, GZMK, HCLS1, IL10RA, IL2RG, IL7R, INPP5D, IRF8, ITK, KLRK1, LCK, LCP2, LPXN, LTB, PIK3CD, PLAC8, PRG1, PRKCB1, PTPRC, RAC2, SAMSSN1, SCYA5, SELL, SD2D1A, SLA, SLAMF1, STAT4, TNFRSF7, TRBC1 |
| MHC I | HLA-A, HLA-B, HLA-C, HLA-F, HLA-G, HLA-J |
| MHC II | HLA-DMA, HLA-DQB1, HLA-DRA, HLA-DRB4 |
| B-cells | CD79B, BTLA, FCRL3, BANK1, CD79A, BLK, RALGPS2, FCRL1, HVCN1, BACH2 |
| Dendritic cells | LILRA4, CLEC4C, PLD4, PHEX, IL3RA, PTCRA, IRF8, IRF7, GZMB, CXCR3 |
| Chemokines | CCL2, CCL3, CCL4, CCL5, CCL11, CXCL9, CXCL10, CXCL11 |
| CD8 | CD8A, CD8B |

Supplementary table 2: Previously published gene expression signatures that were used to compare our prediction models with.

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| **Gene expression signatures** | **Genes** |
| Follicular B helper T cells (Tfh) signature | CD200, CXCL13, FBLN7, ICOS, SGPP2, SH2D1A, TIGIT, PDCD1 |
| T helper cells (Th1) signature | CCND2, CD38, CTLA4, RAB27A, RAB33A, SH2D2A, STAT1, TNFRSF4, IL12RB2, SAMD9L, CXCL9, IFNG |
| Regulatory T cells (Treg) signature | FOXP3, C15orf53, IL5, CTLA4, IL32, GPR15, IL4 |
| STAT1 signature | CXCL10, CXCL11, GBP1, STAT1 |
| Immune1 signature | C1QA, XCL2, SPP1, TNFRSF17, LY9, IGLC2, HLA-F |
| Immune2 signature | STAT1, CXCL10, TAP1, XCL11, CXCL9, MX1, INDO, ISG15, LAMP3, IFIT3, MX2, IFI44L, HERC6, RTP4, CCL5, HERC5, RSAD2, CD2, DDX58, ADAMDEC1, HCP5, FLJ20035, NMI, TFEC, IRF1, TRIM22, SPOCK2, UBD, SP140, CCL8, PSCDBP, CD3G, CTSC, IFI6, PLA2G7, ECGF1, STAT4, LAG3, LYZ, PLAC8, CD48, GZMK, ETV7, FASLG, GPR18, FGL2, IFI30, P2RX5, PTPN7, LAPTM5, IRF8, PIM2, BIRC3, CD69, SH2D1A, IFITM1, IFIT5, GPR171, ITGB2, PSME1, BTN3A2, HCLS1, IGSF6, KLRK1, SECTM1, ARHGAP15, PIP3-E, EBI2, SNX10, FLJ11286, DHX58, BST2, MGC29506, APOC1, VAV1, CLEC4A, LILRA4, ZC3HAV1, CD40LG, DDAH2, CCRL2, GLRX, CECR1, TRGV9, RFX5, ACP5, EBI3, IL18, KLRC3, RAB8A, REC8, RASGRP1, EFNA1, TRAF3, DNAL4 |
| Interferon-γ signature | IL2RG, CXCR6, CD3D, ITGAL, TAGAP, CIITA, HLA-DRA, PTPRC, CXCL9, CCL5, NKG7, GZMA, PRF1, CCR5, CD3E, GZMK, IFNG, HLA-E, GZMB, PDCD1, SLAMF6, CXCL13, CXCL10, IDO1, LAG3, STAT1, CXCL11 |