

**Table S1.** Differential immune marker expression in early-stage lung adenocarcinomas based on TMB

Immune marker	Spearman coefficient	P-value
PD-L1	0.17	0.04*
CD3	0.09	0.32
CD4	0.05	0.59
CD8	-0.00232	0.98
CD68	0.19	0.06

\*:The difference is significant

**Table S2.** Distribution of different NPA in LUAD,MIA, and AIS

NPA	LUAD	MIA	AIS	P value
0	7	7	4	0.813
1	4	11	8	0.007*
2	38	30	15	0.994
$\geq 3$	18	5	0	< 0.0001*

\*:The difference is significant

**Table S3.** The distribution of each immune subtype in different pathological subtypes

Immune Subtypes	LUAD N=60	MIA N=43	AIS N=27	P-value
PDL1+CD8+ (Immune activation)	21 (35.0%)	3 (7.0%)	1 (3.7%)	P < 0.0001*
PDL1+CD8- (Intrinsic induction)	7 (11.7%)	10 (23.3%)	4 (14.8%)	P > 0.05
PDL1-CD8+ (Immune tolerance)	16 (26.7%)	9 (20.9%)	4 (14.8%)	P > 0.05
PDL1-CD8- (Immune ignorance)	16 (26.7%)	21 (48.8%)	18 (66.7%)	P > 0.05

\*:The difference is significant

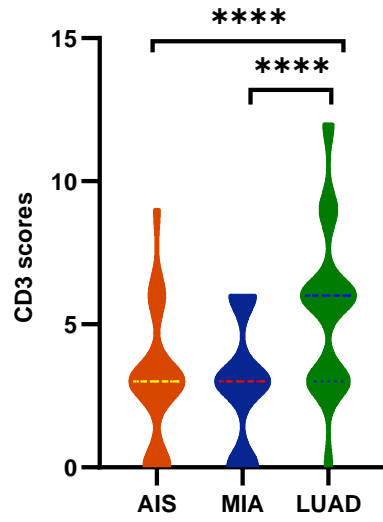
**Table S4.** Mutation frequency of high-frequency mutant genes in (double-negative) DN/ non-DN groups of LUAD

Mutant gene	DN group	non-DN group	Number
EGFR	12(40.0%)	18(60.0%)	30
MUC16	1(16.7%)	5(83.3%)	6
RBM10	3(42.9%)	4(57.1%)	7
TP53	2(33.3%)	4(66.7%)	6
ERBB2	1(50%)	1(50%)	2

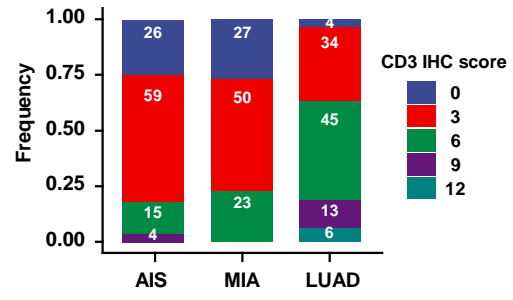
**DN group:** PD-L1<sup>-</sup>CD8<sup>-</sup> subtype

**non-DN group:** PD-L1<sup>+</sup>CD8<sup>+</sup>, PD-L1<sup>+</sup>CD8<sup>-</sup>, PD-L1<sup>-</sup>CD8<sup>+</sup> subtypes

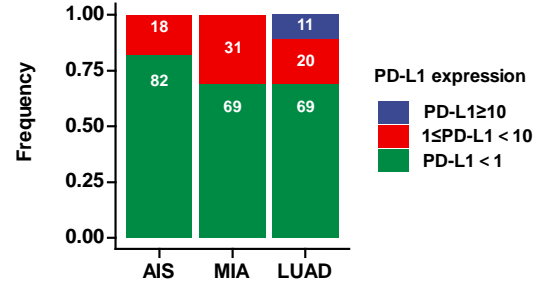
**A**



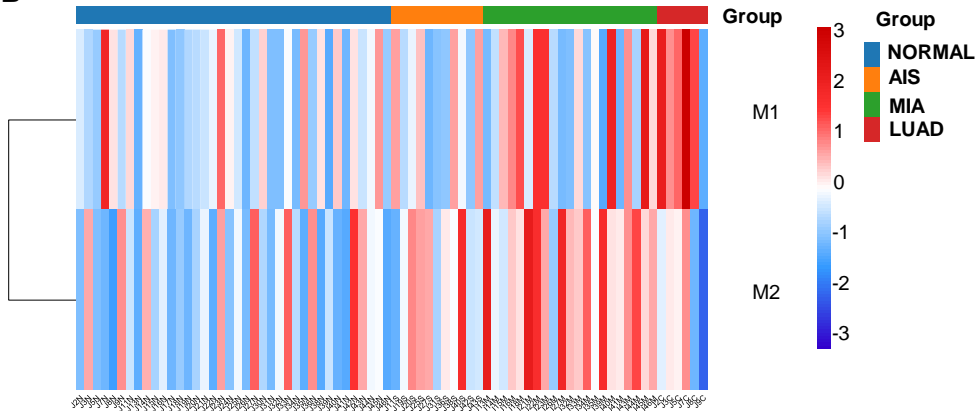
**D**



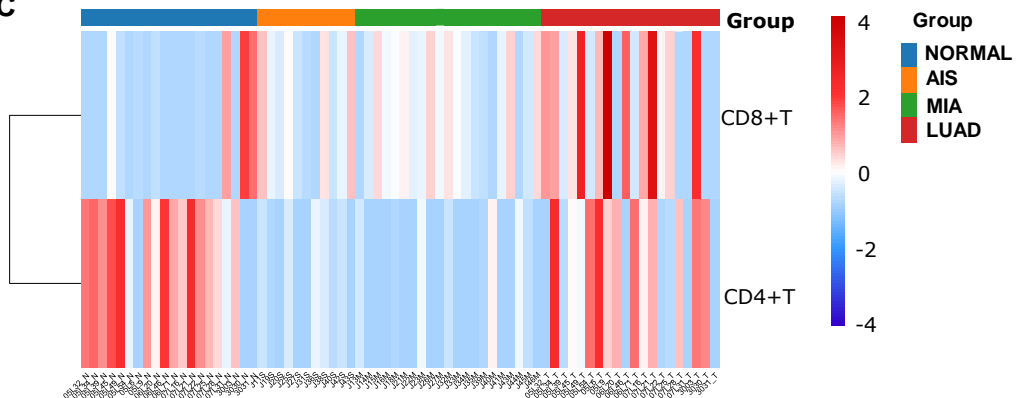
**E**



**B**

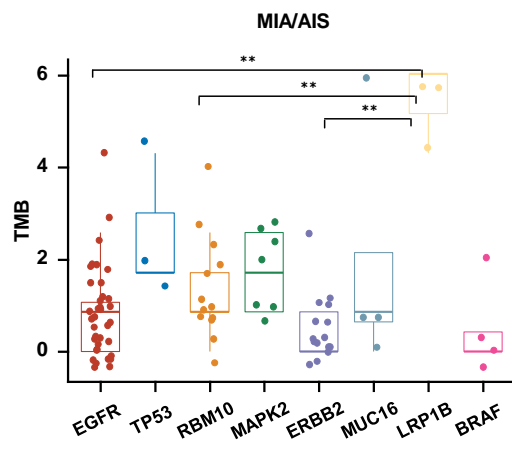
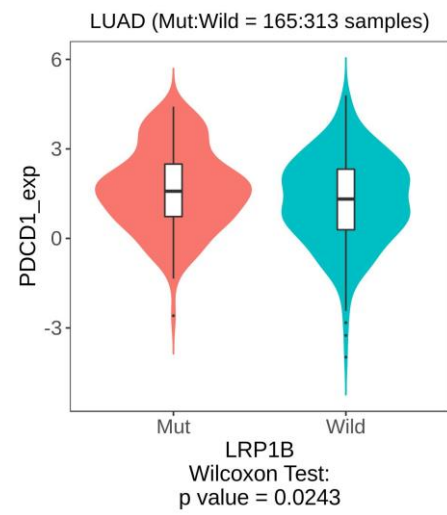
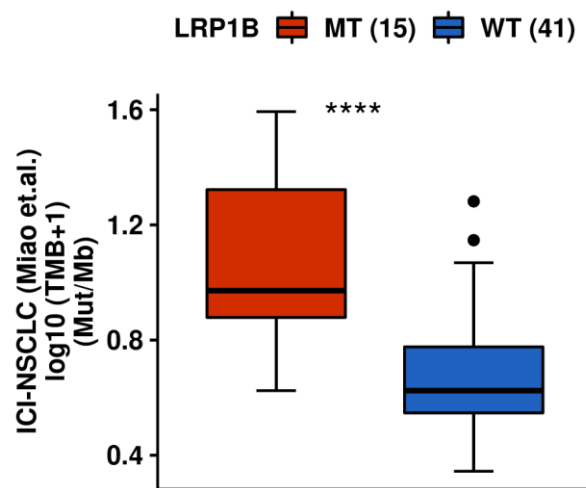


**C**



**Figure S1. Immune characteristics in early-LUAD**

A. Comparison of CD3<sup>+</sup> score in AIS, MIA, and LUAD. B, C. Macrophages(B) and T lymphocytes(C) in AIS, MIA, LUAD, and adjacent normal tissue. D. The distribution of different CD3 scores in all pathological types. E. The distribution of different level of PD-L1 expression in all pathological types.

**A****B****C**

**Figure S2. Genomic characteristics in early-LUAD**

A. TMB levels of samples with high-frequency mutations in MIA/AIS. B. The PD-1 expression in LRP1B-mutated and wild-type LUAD patients. C. The TMB level of LRP1B-mutated and wild-type LUAD patients receiving immune checkpoint inhibitors(ICIs).