```
 1 /System/Volumes/Data/Users/liangwenlong/envs/ml_env
   /bin/python3.12 /Users/liangwenlong/study/bme/3/
   ml_usage/project/solutionv5.1.py
 2 正在读取数据...
 3 正在构建基础物理特征...
 4 正在进行 Target Encoding (OOF)...
 5 将进行 OOF Target Encoding 的列: ['driver_name_and_id
   ', 'vehicle_type', 'vehicle_motortype', '
   deviceuniquecode']
 6 最终特征数: 62
 7 类别特征: []
 8 开始训练 LightGBM (V5.1 - MAE, OOF-TE)...
 9
10 ========== Fold 1/5 ==========
11 Training until validation scores don't improve for
   200 rounds
12 [500]    train's l1: 17.8337 valid's l1: 19.3923
13 [1000]   train's l1: 16.6017 valid's l1: 19.1488
14 [1500]   train's l1: 15.7417 valid's l1: 19.0271
15 [2000]   train's l1: 15.0894 valid's l1: 18.9496
16 [2500]   train's l1: 14.5663 valid's l1: 18.8989
17 [3000]   train's l1: 14.142  valid's l1: 18.8632
18 [3500]   train's l1: 13.7892 valid's l1: 18.8313
19 [4000]   train's l1: 13.4816 valid's l1: 18.8057
20 [4500]   train's l1: 13.2247 valid's l1: 18.7888
21 [5000]   train's l1: 12.9847 valid's l1: 18.7697
22 Did not meet early stopping. Best iteration is:
23 [4985]   train's l1: 12.9921 valid's l1: 18.7696
24 Fold 1 MAE: 18.7696
25
26 ========== Fold 2/5 ==========
27 Training until validation scores don't improve for
   200 rounds
28 [500]    train's l1: 17.7866 valid's l1: 19.5905
29 [1000]   train's l1: 16.4848 valid's l1: 19.327
30 [1500]   train's l1: 15.6363 valid's l1: 19.2135
31 [2000]   train's l1: 14.9968 valid's l1: 19.1481
32 [2500]   train's l1: 14.4788 valid's l1: 19.097
33 [3000]   train's l1: 14.0632 valid's l1: 19.0712
34 [3500]   train's l1: 13.7194 valid's l1: 19.0514
35 [4000]   train's l1: 13.4133 valid's l1: 19.0297
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36 [4500]   train's l1: 13.1497 valid's l1: 19.0125
37 [5000]   train's l1: 12.92   valid's l1: 19.0043
38 Did not meet early stopping. Best iteration is:
39 [4935]   train's l1: 12.9455 valid's l1: 19.004
40 Fold 2 MAE: 19.0040
41
42 ========== Fold 3/5 ==========
43 Training until validation scores don't improve for
   200 rounds
44 [500]    train's l1: 17.8001 valid's l1: 19.7071
45 [1000]   train's l1: 16.506  valid's l1: 19.4238
46 [1500]   train's l1: 15.631  valid's l1: 19.3025
47 [2000]   train's l1: 14.9891 valid's l1: 19.2314
48 [2500]   train's l1: 14.4567 valid's l1: 19.1793
49 [3000]   train's l1: 14.0256 valid's l1: 19.1429
50 [3500]   train's l1: 13.6676 valid's l1: 19.1209
51 [4000]   train's l1: 13.3641 valid's l1: 19.1048
52 [4500]   train's l1: 13.1108 valid's l1: 19.0832
53 [5000]   train's l1: 12.8847 valid's l1: 19.0677
54 Did not meet early stopping. Best iteration is:
55 [4986]   train's l1: 12.89   valid's l1: 19.0675
56 Fold 3 MAE: 19.0675
57
58 ========== Fold 4/5 ==========
59 Training until validation scores don't improve for
   200 rounds
60 [500]    train's l1: 17.8045 valid's l1: 19.6867
61 [1000]   train's l1: 16.4943 valid's l1: 19.3803
62 [1500]   train's l1: 15.6413 valid's l1: 19.2526
63 [2000]   train's l1: 15.0085 valid's l1: 19.1807
64 [2500]   train's l1: 14.4899 valid's l1: 19.1205
65 [3000]   train's l1: 14.0544 valid's l1: 19.0731
66 [3500]   train's l1: 13.696  valid's l1: 19.037
67 [4000]   train's l1: 13.3884 valid's l1: 19.0131
68 [4500]   train's l1: 13.129  valid's l1: 18.9962
69 [5000]   train's l1: 12.9049 valid's l1: 18.9827
70 Did not meet early stopping. Best iteration is:
71 [4995]   train's l1: 12.9067 valid's l1: 18.9826
72 Fold 4 MAE: 18.9826
73
74 ========== Fold 5/5 ==========
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75 Training until validation scores don't improve for
      200 rounds
76 [500]    train's l1: 17.8285 valid's l1: 19.6218
77 [1000]   train's l1: 16.5326 valid's l1: 19.353
78 [1500]   train's l1: 15.672  valid's l1: 19.2313
79 [2000]   train's l1: 15.0088 valid's l1: 19.1619
80 [2500]   train's l1: 14.4791 valid's l1: 19.1098
81 [3000]   train's l1: 14.0527 valid's l1: 19.0741
82 [3500]   train's l1: 13.7022 valid's l1: 19.0493
83 [4000]   train's l1: 13.391  valid's l1: 19.0227
84 [4500]   train's l1: 13.1337 valid's l1: 19.0087
85 [5000]   train's l1: 12.9162 valid's l1: 18.9959
86 Did not meet early stopping. Best iteration is:
87 [5000]   train's l1: 12.9162 valid's l1: 18.9959
88 Fold 5 MAE: 18.9959
89
90 =========================================
91    V5.1 (MAE + OOF-TE) CV Mean MAE: 18.9639
92 =========================================
93 提交文件已生成: submission_v5_1_lgbm_mae_18.9639.csv
94 特征重要性图已保存为 feature_importance_v5_1.png
95
96 进程已结束，退出代码为 0
97
```