```
 1 /Users/mir/PycharmProjects/Asebaie/.venv/bin/python
   /Users/mir/Documents/ITMO Python/Hack_Change/main.
   py
 2 2025-11-29 03:28:01,916 - INFO - === ЗАПУСК
   ОБУЧЕНИЯ ===
 3 2025-11-29 03:28:01,917 - INFO - Загрузка данных...
 4 2025-11-29 03:28:05,020 - INFO - Train: (76786, 224
   ), Test: (73214, 222)
 5 2025-11-29 03:28:05,123 - INFO - Target Encoding (
   CV-safe)...
 6 2025-11-29 03:28:05,776 - INFO - Добавлено 41 enc-
   признаков
 7 2025-11-29 03:28:05,777 - INFO - Импутация
   пропусков и удаление object-колонок...
 8 2025-11-29 03:28:06,893 - INFO - Удалено 41 object-
   колонок. Осталось числовых: 221
 9 2025-11-29 03:28:06,894 - INFO - cat_features
    = [] — только числовые признаки
10 2025-11-29 03:28:06,894 - INFO - Удалено 41 object-
   колонок. Осталось числовых: 221
11 2025-11-29 03:28:06,894 - INFO - Запуск CV-
   валидации (5 фолдов)...
12 2025-11-29 03:28:06,897 - INFO - --- ФОЛД 1/5 ---
13 0:  learn: 0.7156679   test: 0.7292850 best: 0.
   7292850 (0) total: 99.7ms  remaining: 4m 9s
14 200:   learn: 0.2949971   test: 0.3132340 best: 0
   .3132340 (200)  total: 5.35s   remaining: 1m 1s
15 400:   learn: 0.2729248   test: 0.2936682 best: 0
   .2936682 (400)  total: 11.3s   remaining: 59.1s
16 600:   learn: 0.2615687   test: 0.2849323 best: 0
   .2849323 (600)  total: 16.2s   remaining: 51.3s
17 800:   learn: 0.2541911   test: 0.2803607 best: 0
   .2803607 (800)  total: 21.4s   remaining: 45.4s
18 1000:  learn: 0.2488586   test: 0.2775304 best: 0
   .2775304 (1000) total: 26.1s   remaining: 39.1s
19 1200:  learn: 0.2443062   test: 0.2756884 best: 0
   .2756884 (1200) total: 31.1s   remaining: 33.7s
20 1400:  learn: 0.2401138   test: 0.2741457 best: 0
   .2741457 (1400) total: 35.9s   remaining: 28.2s
21 1600:  learn: 0.2363659   test: 0.2728713 best: 0
   .2728713 (1600) total: 40.7s   remaining: 22.9s
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22 1800:    learn: 0.2328400    test: 0.2718831 best: 0
   .2718810 (1798) total: 45.6s    remaining: 17.7s
23 2000:    learn: 0.2295733    test: 0.2711610 best: 0
   .2711610 (2000) total: 50.4s    remaining: 12.6s
24 2200:    learn: 0.2265596    test: 0.2703548 best: 0
   .2703548 (2200) total: 55.4s    remaining: 7.53s
25 2400:    learn: 0.2238194    test: 0.2699429 best: 0
   .2699429 (2400) total: 1m    remaining: 2.49s
26 2499:    learn: 0.2224946    test: 0.2696736 best: 0
   .2696736 (2499) total: 1m 2s    remaining: 0us
27
28 bestTest = 0.2696736241
29 bestIteration = 2499
30
31 2025-11-29 03:29:42,017 - INFO - Фолд 1: WMAE =
   17470
32 2025-11-29 03:29:42,018 - INFO - --- ФОЛД 2/5 ---
33 0:  learn: 0.7210208    test: 0.7076157 best: 0.
   7076157 (0) total: 45.3ms    remaining: 1m 53s
34 200:    learn: 0.2983392    test: 0.3003510 best: 0
   .3003510 (200)  total: 4.59s    remaining: 52.5s
35 400:    learn: 0.2762431    test: 0.2802328 best: 0
   .2802328 (400)  total: 10.6s    remaining: 55.5s
36 600:    learn: 0.2644152    test: 0.2712717 best: 0
   .2712717 (600)  total: 15.4s    remaining: 48.7s
37 800:    learn: 0.2568168    test: 0.2668831 best: 0
   .2668831 (800)  total: 20.5s    remaining: 43.5s
38 1000:    learn: 0.2509991    test: 0.2641921 best: 0
   .2641921 (1000) total: 25.5s    remaining: 38.2s
39 1200:    learn: 0.2463554    test: 0.2624957 best: 0
   .2624947 (1198) total: 30.2s    remaining: 32.7s
40 1400:    learn: 0.2422682    test: 0.2613552 best: 0
   .2613552 (1400) total: 35.1s    remaining: 27.5s
41 1600:    learn: 0.2387962    test: 0.2604821 best: 0
   .2604819 (1598) total: 39.8s    remaining: 22.4s
42 1800:    learn: 0.2352400    test: 0.2597992 best: 0
   .2597963 (1796) total: 44.5s    remaining: 17.3s
43 2000:    learn: 0.2322009    test: 0.2592440 best: 0
   .2592380 (1994) total: 49.3s    remaining: 12.3s
44 2200:    learn: 0.2291761    test: 0.2588336 best: 0
   .2588336 (2200) total: 54.3s    remaining: 7.38s
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45 2400:    learn: 0.2263989    test: 0.2584217 best: 0
   .2584217 (2400) total: 59.1s    remaining: 2.44s
46 2499:    learn: 0.2251217    test: 0.2581845 best: 0
   .2581809 (2497) total: 1m 1s    remaining: 0us
47
48 bestTest = 0.2581809224
49 bestIteration = 2497
50
51 Shrink model to first 2498 iterations.
52 2025-11-29 03:31:07,251 - INFO - Фолд 2: WMAE =
   16181
53 2025-11-29 03:31:07,252 - INFO - --- ФОЛД 3/5 ---
54 0:  learn: 0.7156884    test: 0.7301258 best: 0.
   7301258 (0) total: 56.6ms    remaining: 2m 21s
55 200:    learn: 0.2977685    test: 0.3006837 best: 0
   .3006837 (200)  total: 4.86s    remaining: 55.6s
56 400:    learn: 0.2757934    test: 0.2808708 best: 0
   .2808708 (400)  total: 9.62s    remaining: 50.4s
57 600:    learn: 0.2642810    test: 0.2720375 best: 0
   .2720375 (600)  total: 14.2s    remaining: 45s
58 800:    learn: 0.2566484    test: 0.2676787 best: 0
   .2676787 (800)  total: 18.9s    remaining: 40.1s
59 1000:    learn: 0.2506621    test: 0.2650823 best: 0
   .2650823 (1000) total: 23.6s    remaining: 35.3s
60 1200:    learn: 0.2454374    test: 0.2633510 best: 0
   .2633510 (1200) total: 28.6s    remaining: 30.9s
61 1400:    learn: 0.2413423    test: 0.2621782 best: 0
   .2621782 (1400) total: 33.3s    remaining: 26.1s
62 1600:    learn: 0.2376018    test: 0.2613240 best: 0
   .2613240 (1600) total: 38.2s    remaining: 21.4s
63 1800:    learn: 0.2340980    test: 0.2605912 best: 0
   .2605912 (1800) total: 42.9s    remaining: 16.7s
64 2000:    learn: 0.2311440    test: 0.2598960 best: 0
   .2598960 (2000) total: 47.6s    remaining: 11.9s
65 2200:    learn: 0.2282680    test: 0.2595022 best: 0
   .2595008 (2190) total: 52.3s    remaining: 7.11s
66 2400:    learn: 0.2253021    test: 0.2589904 best: 0
   .2589901 (2398) total: 57.2s    remaining: 2.36s
67 2499:    learn: 0.2240129    test: 0.2587711 best: 0
   .2587679 (2497) total: 59.7s    remaining: 0us
68
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69 bestTest = 0.2587678972
70 bestIteration = 2497
71
72 Shrink model to first 2498 iterations.
73 2025-11-29 03:32:33,919 - INFO - Фолд 3: WMAE =
   16978
74 2025-11-29 03:32:33,920 - INFO - --- ФОЛД 4/5 ---
75 0:  learn: 0.7207289   test: 0.7104158 best: 0.
   7104158 (0) total: 58.4ms  remaining: 2m 25s
76 200:   learn: 0.2996769   test: 0.2922416 best:
   0.2922416 (200) total: 5.07s   remaining: 58s
77 400:   learn: 0.2778945   test: 0.2734185 best:
   0.2734185 (400) total: 9.94s   remaining: 52s
78 600:   learn: 0.2662608   test: 0.2649361 best:
   0.2649361 (600) total: 14.7s   remaining: 46.3s
79 800:   learn: 0.2580007   test: 0.2605564 best:
   0.2605564 (800) total: 19.4s   remaining: 41.2s
80 1000:   learn: 0.2521660   test: 0.2582887 best:
   0.2582884 (999) total: 24.1s   remaining: 36.1s
81 1200:   learn: 0.2473492   test: 0.2567601 best:
   0.2567481 (1193)  total: 28.8s   remaining: 31.
   2s
82 1400:   learn: 0.2432374   test: 0.2554911 best:
   0.2554876 (1398)  total: 33.9s   remaining: 26.
   6s
83 1600:   learn: 0.2395032   test: 0.2545679 best:
   0.2545679 (1600)  total: 38.6s   remaining: 21.
   7s
84 1800:   learn: 0.2362849   test: 0.2537225 best:
   0.2537205 (1799)  total: 43.3s   remaining: 16.
   8s
85 2000:   learn: 0.2333635   test: 0.2531496 best:
   0.2531496 (2000)  total: 47.9s   remaining: 11.
   9s
86 2200:   learn: 0.2303384   test: 0.2525962 best:
   0.2525962 (2200)  total: 52.6s   remaining: 7.
   14s
87 2400:   learn: 0.2276690   test: 0.2519976 best:
   0.2519972 (2386)  total: 57.3s   remaining: 2.
   36s
88 2499:   learn: 0.2263860   test: 0.2518487 best:
```

```
 88 0.2518487 (2499)    total: 59.6s    remaining: 0us
 89
 90 bestTest = 0.251848705
 91 bestIteration = 2499
 92
 93 2025-11-29 03:33:56,634 - INFO - Фолд 4: WMAE =
    14867
 94 2025-11-29 03:33:56,636 - INFO - --- ФОЛД 5/5 ---
 95 0:  learn: 0.7192898   test: 0.7148762 best: 0.
    7148762 (0) total: 57.4ms   remaining: 2m 23s
 96 200:    learn: 0.2981683   test: 0.2984895 best:
    0.2984895 (200) total: 4.92s    remaining: 56.3s
 97 400:    learn: 0.2755520   test: 0.2803325 best:
    0.2803325 (400) total: 10.1s    remaining: 52.8s
 98 600:    learn: 0.2633522   test: 0.2723457 best:
    0.2723457 (600) total: 14.9s    remaining: 47.2s
 99 800:    learn: 0.2556811   test: 0.2682125 best:
    0.2682125 (800) total: 19.8s    remaining: 42s
100 1000:   learn: 0.2495265   test: 0.2656746 best:
    0.2656746 (1000)   total: 24.6s   remaining: 36.
    9s
101 1200:   learn: 0.2450972   test: 0.2642992 best:
    0.2642988 (1199)   total: 29.4s   remaining: 31.
    8s
102 1400:   learn: 0.2411802   test: 0.2632512 best:
    0.2632480 (1398)   total: 34.2s   remaining: 26.
    8s
103 1600:   learn: 0.2372407   test: 0.2623558 best:
    0.2623542 (1599)   total: 39.2s   remaining: 22s
104 1800:   learn: 0.2336000   test: 0.2617648 best:
    0.2617500 (1784)   total: 44s  remaining: 17.1s
105 2000:   learn: 0.2302107   test: 0.2610797 best:
    0.2610791 (1999)   total: 48.8s   remaining: 12.
    2s
106 2200:   learn: 0.2272354   test: 0.2605925 best:
    0.2605925 (2200)   total: 53.7s   remaining: 7.
    29s
107 2400:   learn: 0.2245451   test: 0.2602767 best:
    0.2602767 (2400)   total: 58.4s   remaining: 2.
    41s
108 2499:   learn: 0.2231751   test: 0.2600607 best:
```

```
108 0.2600602 (2498)    total: 1m   remaining: 0us
109
110 bestTest = 0.2600601848
111 bestIteration = 2498
112
113 Shrink model to first 2499 iterations.
114 2025-11-29 03:35:17,323 - INFO - Фолд 5: WMAE =
    16790
115 2025-11-29 03:35:17,325 - INFO - CV WMAE: 16457 ±
    896
116 2025-11-29 03:35:17,325 - INFO - Финальное
    обучение на всех данных...
117 0:  learn: 0.7183713   test: 0.7183713 best: 0.
    7183713 (0) total: 58.1ms   remaining: 2m 25s
118 200:   learn: 0.2970515   test: 0.2970515 best:
    0.2970515 (200) total: 5.44s    remaining: 1m 2s
119 400:   learn: 0.2756220   test: 0.2756220 best:
    0.2756220 (400) total: 11.7s    remaining: 1m 1s
120 600:   learn: 0.2645867   test: 0.2645867 best:
    0.2645867 (600) total: 17.6s    remaining: 55.6s
121 800:   learn: 0.2571315   test: 0.2571315 best:
    0.2571315 (800) total: 22.9s    remaining: 48.7s
122 1000:   learn: 0.2515894   test: 0.2515894 best:
    0.2515894 (1000)   total: 28.3s   remaining: 42.
    4s
123 1200:   learn: 0.2473174   test: 0.2473174 best:
    0.2473174 (1200)   total: 33.6s   remaining: 36.
    3s
124 1400:   learn: 0.2436478   test: 0.2436478 best:
    0.2436478 (1400)   total: 38.8s   remaining: 30.
    4s
125 1600:   learn: 0.2405223   test: 0.2405223 best:
    0.2405223 (1600)   total: 43.9s   remaining: 24.
    6s
126 1800:   learn: 0.2374514   test: 0.2374514 best:
    0.2374514 (1800)   total: 49.4s   remaining: 19.
    2s
127 2000:   learn: 0.2346736   test: 0.2346736 best:
    0.2346736 (2000)   total: 54.8s   remaining: 13.
    7s
128 2200:   learn: 0.2321129   test: 0.2321129 best:
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128 0.2321129 (2200)     total: 1m 1s     remaining: 8.
    32s
129 2400:    learn: 0.2295534    test: 0.2295534 best:
    0.2295534 (2400)    total: 1m 6s     remaining: 2.
    75s
130 2499:    learn: 0.2283393    test: 0.2283393 best:
    0.2283393 (2499)    total: 1m 9s     remaining: 0us
131
132 bestTest = 0.2283392706
133 bestIteration = 2499
134
135 /Users/mir/PyCharmProjects/Asebaie/.venv/lib/
    python3.12/site-packages/lightgbm/callback.py:347
    : UserWarning: Only training set found, disabling
    early stopping.
136   _log_warning("Only training set found, disabling
     early stopping.")
137 2025-11-29 03:37:01,171 - INFO - Предсказание на
    test...
138 2025-11-29 03:37:03,830 - INFO -
    submission_UNDER_35K.csv — СОЗДАН
139 2025-11-29 03:37:03,831 - INFO - Сохранение модели
     и SHAP...
140 2025-11-29 03:37:05,208 - INFO - model_bundle.pkl
    — СОХРАНЁН
141 2025-11-29 03:37:05,208 - INFO - cv_report.txt —
    СОЗДАН
142 2025-11-29 03:37:05,208 - INFO - === ОБУЧЕНИЕ
    УСПЕШНО ЗАВЕРШЕНО ===
143
144 Process finished with exit code 0
145
```