```
=== GPU Information ===
NVIDIA A100-SXM4-40GB, 40960 MiB, 580.95.05
NVIDIA A100-SXM4-40GB, 40960 MiB, 580.95.05
NVIDIA A100-SXM4-40GB, 40960 MiB, 580.95.05
NVIDIA A100-SXM4-40GB, 40960 MiB, 580.95.05
=== Checking if supervised_vision_ccs.py exists ===
-rw-r-----. 1 mdemirev mdemirev 13K Oct 22 22:30 supervised_vision_ccs.py
=== Running supervised_vision_ccs.py ===
/home/mdemirev/.local/lib/python3.11/site-packages/huggingface_hub/file_download.py:945:
FutureWarning: `resume_download` is deprecated and will be removed in version 1.0.0. Downloads
always resume when possible. If you want to force a new download, use `force_download=True`.
  warnings.warn(
Special tokens have been added in the vocabulary, make sure the associated word embeddings are
fine-tuned or trained.


=======================================================================
                SUPERVISED VISION CLASSIFICATION
        LLaVA + Logistic Regression
=======================================================================

Configuration:
  Model: llava-hf/llava-1.5-7b-hf
  Samples per category:
    - object_detection: 1323
    - attribute_recognition: 3410
    - spatial_recognition: 1030
  Batch size: 40
  Cache enabled: False
  Categories: object_detection, attribute_recognition, spatial_recognition

Logistic Regression:
  C (inverse regularization): 1.0
  Solver: lbfgs
  Max iterations: 1000


#######################################################################
# CATEGORY: OBJECT_DETECTION
#######################################################################
LOADING DATA for category: 'object_detection'
Using 1323 samples from 'object_detection'


=======================================================================
EXTRACTING HIDDEN STATES: OBJECT_DETECTION
=======================================================================
⚠ Cache disabled (use_cache=False). Extracting new...

Processing 1323 samples in batches of 40
Searching in 2 image directories


=======================================================================
LOADING LLAVA MODEL: llava-hf/llava-1.5-7b-hf
=======================================================================
Device: cuda

Loading checkpoint shards:   0%|            | 0/3 [00:00<?, ?it/s]
Loading checkpoint shards:  33%|███▍        | 1/3 [00:06<00:12,  6.18s/it]
Loading checkpoint shards:  67%|██████▋     | 2/3 [00:11<00:05,  5.89s/it]
Loading checkpoint shards: 100%|██████████| 3/3 [00:16<00:00,  5.39s/it]
Loading checkpoint shards: 100%|██████████| 3/3 [00:16<00:00,  5.55s/it]
✓ Model loaded successfully


Batches:   0%|          | 0/34 [00:00<?, ?it/s]
Batches:   3%|▎         | 1/34 [00:07<03:53,  7.07s/it]
Batches:   6%|▌         | 2/34 [00:13<03:37,  6.79s/it]
Batches:   9%|▉         | 3/34 [00:19<03:15,  6.29s/it]
Batches:  12%|█▏        | 4/34 [00:25<03:03,  6.13s/it]
```

```
Batches:  15%|██       | 5/34 [00:30<02:53,  5.98s/it]
Batches:  18%|██       | 6/34 [00:37<02:51,  6.12s/it]
Batches:  21%|██       | 7/34 [00:43<02:44,  6.10s/it]
Batches:  24%|██       | 8/34 [00:48<02:34,  5.93s/it]
Batches:  26%|██       | 9/34 [00:54<02:27,  5.92s/it]
Batches:  29%|██       | 10/34 [01:01<02:24,  6.01s/it]
Batches:  32%|██       | 11/34 [01:07<02:18,  6.03s/it]
Batches:  35%|███      | 12/34 [01:13<02:11,  5.99s/it]
Batches:  38%|███      | 13/34 [01:17<01:57,  5.61s/it]
Batches:  41%|███      | 14/34 [01:24<01:55,  5.79s/it]
Batches:  44%|███      | 15/34 [01:29<01:47,  5.67s/it]
Batches:  47%|████     | 16/34 [01:35<01:45,  5.88s/it]
Batches:  50%|████     | 17/34 [01:41<01:38,  5.77s/it]
Batches:  53%|████     | 18/34 [01:47<01:34,  5.92s/it]
Batches:  56%|████     | 19/34 [01:54<01:32,  6.18s/it]
Batches:  59%|█████    | 20/34 [02:00<01:25,  6.10s/it]
Batches:  62%|█████    | 21/34 [02:06<01:19,  6.09s/it]
Batches:  65%|█████    | 22/34 [02:11<01:11,  5.96s/it]
Batches:  68%|█████    | 23/34 [02:18<01:05,  5.99s/it]
Batches:  71%|██████   | 24/34 [02:24<01:02,  6.23s/it]
Batches:  74%|██████   | 25/34 [02:31<00:56,  6.23s/it]
Batches:  76%|██████   | 26/34 [02:36<00:48,  6.09s/it]
Batches:  79%|███████  | 27/34 [02:43<00:43,  6.19s/it]
Batches:  82%|███████  | 28/34 [02:48<00:35,  5.95s/it]
Batches:  85%|███████  | 29/34 [02:54<00:29,  5.97s/it]
Batches:  88%|███████  | 30/34 [03:00<00:23,  5.89s/it]
Batches:  91%|████████ | 31/34 [03:06<00:17,  5.88s/it]
Batches:  94%|████████ | 32/34 [03:11<00:11,  5.74s/it]
Batches:  97%|████████ | 33/34 [03:17<00:05,  5.73s/it]
Batches: 100%|█████████| 34/34 [03:17<00:00,  4.20s/it]
Batches: 100%|█████████| 34/34 [03:17<00:00,  5.82s/it]
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.1s finished
/home/mdemirev/.local/lib/python3.11/site-packages/huggingface_hub/file_download.py:945:
FutureWarning: `resume_download` is deprecated and will be removed in version 1.0.0. Downloads
always resume when possible. If you want to force a new download, use `force_download=True`.
  warnings.warn(
Special tokens have been added in the vocabulary, make sure the associated word embeddings are
fine-tuned or trained.


======================================================================
EXTRACTION COMPLETE
======================================================================
✓ Successfully processed: 1140/1323
✗ Skipped (missing/error): 183/1323

First 10 skipped: 000000262227.jpg, 000000262440.jpg, 000000262440.jpg, 000000262682.jpg,
000000262682.jpg, 000000262682.jpg, 000000139684.jpg, 000000000632.jpg, 000000000632.jpg,
000000000632.jpg...

Extracted shapes:
  Hidden states: (1140, 4096)
  Labels: (1140,)

Cached to: hidden_states_cache/cache_object_detection_1323_supervised_llava.npz


======================================================================
TRAINING SUPERVISED LOGISTIC REGRESSION
======================================================================

Dataset split (Stratified):
  Train: 797 samples (403 pos, 394 neg)
```

```
   Test:  343 samples (173 pos, 170 neg)
   Hidden dim: 4096

 Logistic Regression config:
   C (inverse regularization): 1.0
   Solver: lbfgs
   Max iterations: 1000

 Training...
 ✓ Training complete!


 ======================================================================
 EVALUATION
 ======================================================================

 Training Accuracy: 100.0%
 Test Accuracy: 77.0%

 Test Results (Class-wise):
   Positive samples: 77.5% (173 samples)
   Negative samples: 76.5% (170 samples)

 Classification Report:
             precision    recall  f1-score   support

         No       0.77      0.76      0.77       170
        Yes       0.77      0.77      0.77       173

   accuracy                           0.77       343
  macro avg       0.77      0.77      0.77       343
weighted avg       0.77      0.77      0.77       343


 ✓ COMPLETE: object_detection → 77.0%


 #########################################################################
 # CATEGORY: ATTRIBUTE_RECOGNITION
 #########################################################################
 LOADING DATA for category: 'attribute_recognition'
 Using 3410 samples from 'attribute_recognition'


 ======================================================================
 EXTRACTING HIDDEN STATES: ATTRIBUTE_RECOGNITION
 ======================================================================
 ⚠ Cache disabled (use_cache=False). Extracting new...

 Processing 3410 samples in batches of 40
 Searching in 2 image directories


 ======================================================================
 LOADING LLAVA MODEL: llava-hf/llava-1.5-7b-hf
 ======================================================================
 Device: cuda

 Loading checkpoint shards:   0%|          | 0/3 [00:00<?, ?it/s]
 Loading checkpoint shards:  33%|███       | 1/3 [00:02<00:04,  2.42s/it]
 Loading checkpoint shards:  67%|██████▋   | 2/3 [00:04<00:02,  2.33s/it]
 Loading checkpoint shards: 100%|██████████| 3/3 [00:06<00:00,  2.15s/it]
 Loading checkpoint shards: 100%|██████████| 3/3 [00:06<00:00,  2.21s/it]
 ✓ Model loaded successfully


 Batches:   0%|          | 0/86 [00:00<?, ?it/s]
 Batches:   1%|          | 1/86 [00:06<09:03,  6.39s/it]
 Batches:   2%||         | 2/86 [00:13<09:26,  6.74s/it]
 Batches:   3%|▍         | 3/86 [00:20<09:15,  6.69s/it]
 Batches:   5%|▍         | 4/86 [00:25<08:43,  6.38s/it]
```

```
Batches:    6%|▌            |  5/86 [00:32<08:48,  6.52s/it]
Batches:    7%|▋            |  6/86 [00:38<08:20,  6.25s/it]
Batches:    8%|█            |  7/86 [00:44<08:17,  6.30s/it]
Batches:    9%|█            |  8/86 [00:49<07:28,  5.75s/it]
Batches:   10%|█            |  9/86 [00:55<07:22,  5.75s/it]
Batches:   12%|█▏           | 10/86 [01:00<07:05,  5.60s/it]
Batches:   13%|█▎           | 11/86 [01:06<07:13,  5.78s/it]
Batches:   14%|█▍           | 12/86 [01:12<07:04,  5.74s/it]
Batches:   15%|█▌           | 13/86 [01:17<06:55,  5.69s/it]
Batches:   16%|█▋           | 14/86 [01:23<06:49,  5.69s/it]
Batches:   17%|█▊           | 15/86 [01:29<06:55,  5.85s/it]
Batches:   19%|█▉           | 16/86 [01:36<07:08,  6.12s/it]
Batches:   20%|██           | 17/86 [01:42<07:07,  6.20s/it]
Batches:   21%|██           | 18/86 [01:48<06:41,  5.90s/it]
Batches:   22%|██▏          | 19/86 [01:53<06:35,  5.90s/it]
Batches:   23%|██▎          | 20/86 [02:00<06:39,  6.05s/it]
Batches:   24%|██▍          | 21/86 [02:06<06:40,  6.16s/it]
Batches:   26%|██▌          | 22/86 [02:13<06:43,  6.31s/it]
Batches:   27%|██▋          | 23/86 [02:19<06:39,  6.34s/it]
Batches:   28%|██▊          | 24/86 [02:25<06:20,  6.14s/it]
Batches:   29%|██▉          | 25/86 [02:32<06:25,  6.32s/it]
Batches:   30%|███          | 26/86 [02:38<06:20,  6.35s/it]
Batches:   31%|███          | 27/86 [02:44<06:03,  6.16s/it]
Batches:   33%|███▎         | 28/86 [02:49<05:46,  5.97s/it]
Batches:   34%|███▍         | 29/86 [02:56<05:45,  6.06s/it]
Batches:   35%|███▌         | 30/86 [03:01<05:30,  5.91s/it]
Batches:   36%|███▌         | 31/86 [03:07<05:28,  5.97s/it]
Batches:   37%|███▋         | 32/86 [03:14<05:37,  6.26s/it]
Batches:   38%|███▊         | 33/86 [03:20<05:23,  6.10s/it]
Batches:   40%|███▉         | 34/86 [03:25<05:06,  5.89s/it]
Batches:   41%|████         | 35/86 [03:32<05:13,  6.14s/it]
Batches:   42%|████▏        | 36/86 [03:39<05:16,  6.32s/it]
Batches:   43%|████▎        | 37/86 [03:45<05:06,  6.26s/it]
Batches:   44%|████▍        | 38/86 [03:51<04:57,  6.21s/it]
Batches:   45%|████▌        | 39/86 [03:57<04:42,  6.01s/it]
Batches:   47%|████▋        | 40/86 [04:03<04:36,  6.02s/it]
Batches:   48%|████▊        | 41/86 [04:09<04:33,  6.08s/it]
Batches:   49%|████▉        | 42/86 [04:14<04:15,  5.82s/it]
Batches:   50%|█████        | 43/86 [04:20<04:13,  5.89s/it]
Batches:   51%|█████        | 44/86 [04:26<04:06,  5.88s/it]
Batches:   52%|█████▏       | 45/86 [04:32<04:03,  5.93s/it]
Batches:   53%|█████▎       | 46/86 [04:38<03:58,  5.96s/it]
Batches:   55%|█████▍       | 47/86 [04:44<03:55,  6.04s/it]
Batches:   56%|█████▌       | 48/86 [04:51<03:55,  6.19s/it]
Batches:   57%|█████▋       | 49/86 [04:57<03:43,  6.05s/it]
Batches:   58%|█████▊       | 50/86 [05:02<03:36,  6.00s/it]
Batches:   59%|█████▉       | 51/86 [05:09<03:34,  6.12s/it]
Batches:   60%|██████       | 52/86 [05:15<03:24,  6.00s/it]
Batches:   62%|██████       | 53/86 [05:21<03:23,  6.18s/it]
Batches:   63%|██████▎      | 54/86 [05:28<03:21,  6.29s/it]
Batches:   64%|██████▍      | 55/86 [05:34<03:12,  6.22s/it]
Batches:   65%|██████▌      | 56/86 [05:40<03:05,  6.17s/it]
Batches:   66%|██████▌      | 57/86 [05:47<03:03,  6.34s/it]
Batches:   67%|██████▋      | 58/86 [05:53<03:00,  6.46s/it]
Batches:   69%|██████▊      | 59/86 [06:00<02:58,  6.59s/it]
```

```
Batches:  70%|██████    | 60/86 [06:06<02:46,  6.39s/it]
Batches:  71%|███████   | 61/86 [06:13<02:40,  6.43s/it]
Batches:  72%|███████   | 62/86 [06:19<02:32,  6.37s/it]
Batches:  73%|███████   | 63/86 [06:25<02:22,  6.19s/it]
Batches:  74%|███████   | 64/86 [06:31<02:18,  6.29s/it]
Batches:  76%|███████   | 65/86 [06:37<02:09,  6.17s/it]
Batches:  77%|███████   | 66/86 [06:44<02:05,  6.28s/it]
Batches:  78%|███████   | 67/86 [06:49<01:55,  6.07s/it]
Batches:  79%|███████   | 68/86 [06:54<01:43,  5.76s/it]
Batches:  80%|████████  | 69/86 [07:00<01:37,  5.74s/it]
Batches:  81%|████████  | 70/86 [07:06<01:34,  5.89s/it]
Batches:  83%|████████  | 71/86 [07:12<01:29,  5.99s/it]
Batches:  84%|████████  | 72/86 [07:18<01:23,  5.96s/it]
Batches:  85%|████████  | 73/86 [07:24<01:16,  5.85s/it]
Batches:  86%|████████  | 74/86 [07:30<01:12,  6.07s/it]
Batches:  87%|████████  | 75/86 [07:36<01:06,  6.06s/it]
Batches:  88%|████████  | 76/86 [07:43<01:01,  6.13s/it]
Batches:  90%|█████████ | 77/86 [07:49<00:54,  6.01s/it]
Batches:  91%|█████████ | 78/86 [07:55<00:49,  6.18s/it]
Batches:  92%|█████████ | 79/86 [08:01<00:41,  5.99s/it]
Batches:  93%|█████████ | 80/86 [08:07<00:36,  6.02s/it]
Batches:  94%|█████████ | 81/86 [08:13<00:30,  6.14s/it]
Batches:  95%|█████████ | 82/86 [08:19<00:23,  5.92s/it]
Batches:  97%|█████████ | 83/86 [08:25<00:18,  6.17s/it]
Batches:  98%|█████████ | 84/86 [08:31<00:12,  6.08s/it]
Batches:  99%|█████████ | 85/86 [08:38<00:06,  6.23s/it]
Batches: 100%|██████████| 86/86 [08:40<00:00,  4.90s/it]
Batches: 100%|██████████| 86/86 [08:40<00:00,  6.05s/it]
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.4s finished
/home/mdemirev/.local/lib/python3.11/site-packages/huggingface_hub/file_download.py:945:
FutureWarning: `resume_download` is deprecated and will be removed in version 1.0.0. Downloads
always resume when possible. If you want to force a new download, use `force_download=True`.
  warnings.warn(
Special tokens have been added in the vocabulary, make sure the associated word embeddings are
fine-tuned or trained.


=======================================================================
EXTRACTION COMPLETE
=======================================================================
✓ Successfully processed: 3002/3410
✗ Skipped (missing/error): 408/3410

First 10 skipped: 000000393282.jpg, 000000393282.jpg, 000000393282.jpg, 000000393469.jpg,
000000000285.jpg, 000000262440.jpg, 000000262440.jpg, 000000262440.jpg, 000000262440.jpg,
000000131386.jpg...

Extracted shapes:
  Hidden states: (3002, 4096)
  Labels: (3002,)

Cached to: hidden_states_cache/cache_attribute_recognition_3410_supervised_llava.npz


=======================================================================
TRAINING SUPERVISED LOGISTIC REGRESSION
=======================================================================

Dataset split (Stratified):
  Train: 2101 samples (1062 pos, 1039 neg)
  Test:  901 samples (456 pos, 445 neg)
  Hidden dim: 4096
```

```
Logistic Regression config:
  C (inverse regularization): 1.0
  Solver: lbfgs
  Max iterations: 1000

Training...
✓ Training complete!


===========================================================================
EVALUATION
===========================================================================

Training Accuracy: 100.0%
Test Accuracy: 74.4%

Test Results (Class-wise):
  Positive samples: 75.0% (456 samples)
  Negative samples: 73.7% (445 samples)

Classification Report:
             precision    recall  f1-score   support

         No       0.74      0.74      0.74       445
        Yes       0.75      0.75      0.75       456

   accuracy                           0.74       901
  macro avg       0.74      0.74      0.74       901
weighted avg      0.74      0.74      0.74       901


✓ COMPLETE: attribute_recognition → 74.4%

###########################################################################
# CATEGORY: SPATIAL_RECOGNITION
###########################################################################
LOADING DATA for category: 'spatial_recognition'
Using 1030 samples from 'spatial_recognition'


===========================================================================
EXTRACTING HIDDEN STATES: SPATIAL_RECOGNITION
===========================================================================
⚠ Cache disabled (use_cache=False). Extracting new...

Processing 1030 samples in batches of 40
Searching in 2 image directories


===========================================================================
LOADING LLAVA MODEL: llava-hf/llava-1.5-7b-hf
===========================================================================
Device: cuda

Loading checkpoint shards:   0%|          | 0/3 [00:00<?, ?it/s]
Loading checkpoint shards:  33%|███       | 1/3 [00:02<00:04,  2.31s/it]
Loading checkpoint shards:  67%|██████    | 2/3 [00:04<00:02,  2.22s/it]
Loading checkpoint shards: 100%|████████  | 3/3 [00:06<00:00,  2.06s/it]
Loading checkpoint shards: 100%|████████  | 3/3 [00:06<00:00,  2.11s/it]
✓ Model loaded successfully


Batches:   0%|          | 0/26 [00:00<?, ?it/s]
Batches:   4%|▌         | 1/26 [00:06<02:43,  6.54s/it]
Batches:   8%|█         | 2/26 [00:13<02:39,  6.65s/it]
Batches:  12%|█▌        | 3/26 [00:18<02:14,  5.83s/it]
Batches:  15%|██        | 4/26 [00:24<02:10,  5.94s/it]
Batches:  19%|██▌       | 5/26 [00:30<02:05,  5.99s/it]
Batches:  23%|███       | 6/26 [00:36<02:01,  6.05s/it]
```

```
Batches:  27%|██▊         | 7/26 [00:42<01:56,  6.12s/it]
Batches:  31%|███         | 8/26 [00:48<01:49,  6.10s/it]
Batches:  35%|███▌        | 9/26 [00:54<01:39,  5.86s/it]
Batches:  38%|███▊        | 10/26 [01:00<01:34,  5.92s/it]
Batches:  42%|████▏       | 11/26 [01:06<01:30,  6.01s/it]
Batches:  46%|████▌       | 12/26 [01:12<01:23,  5.97s/it]
Batches:  50%|█████       | 13/26 [01:17<01:15,  5.84s/it]
Batches:  54%|█████▍      | 14/26 [01:22<01:07,  5.59s/it]
Batches:  58%|█████▊      | 15/26 [01:28<01:02,  5.64s/it]
Batches:  62%|██████▏     | 16/26 [01:34<00:56,  5.66s/it]
Batches:  65%|██████▌     | 17/26 [01:40<00:51,  5.69s/it]
Batches:  69%|██████▉     | 18/26 [01:45<00:45,  5.70s/it]
Batches:  73%|███████▎    | 19/26 [01:52<00:41,  5.87s/it]
Batches:  77%|███████▋    | 20/26 [01:58<00:36,  6.02s/it]
Batches:  81%|████████▏   | 21/26 [02:03<00:29,  5.83s/it]
Batches:  85%|████████▌   | 22/26 [02:10<00:23,  5.95s/it]
Batches:  88%|████████▊   | 23/26 [02:15<00:17,  5.89s/it]
Batches:  92%|█████████▏  | 24/26 [02:22<00:12,  6.01s/it]
Batches:  96%|█████████▌  | 25/26 [02:27<00:05,  5.91s/it]
Batches: 100%|██████████  | 26/26 [02:32<00:00,  5.56s/it]
Batches: 100%|██████████  | 26/26 [02:32<00:00,  5.86s/it]
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
[Parallel(n_jobs=1)]: Done    1 out of    1 | elapsed:      0.1s finished


========================================================================
EXTRACTION COMPLETE
========================================================================
✓ Successfully processed: 880/1030
✗ Skipped (missing/error): 150/1030

First 10 skipped: 000000393282.jpg, 000000000285.jpg, 000000262682.jpg, 000000000632.jpg,
000000262895.jpg, 000000043816.jpg, 000000043816.jpg, 000000043816.jpg, 000000043816.jpg,
000000000785.jpg...

Extracted shapes:
  Hidden states: (880, 4096)
  Labels: (880,)

Cached to: hidden_states_cache/cache_spatial_recognition_1030_supervised_llava.npz


========================================================================
TRAINING SUPERVISED LOGISTIC REGRESSION
========================================================================

Dataset split (Stratified):
  Train: 615 samples (294 pos, 321 neg)
  Test:  265 samples (126 pos, 139 neg)
  Hidden dim: 4096

Logistic Regression config:
  C (inverse regularization): 1.0
  Solver: lbfgs
  Max iterations: 1000

Training...
✓ Training complete!


========================================================================
EVALUATION
========================================================================

Training Accuracy: 100.0%
Test Accuracy: 67.5%

Test Results (Class-wise):
```

```
  Positive samples: 63.5% (126 samples)
  Negative samples: 71.2% (139 samples)


Classification Report:
              precision    recall  f1-score   support

          No       0.68      0.71      0.70       139
         Yes       0.67      0.63      0.65       126

    accuracy                           0.68       265
   macro avg       0.67      0.67      0.67       265
weighted avg       0.68      0.68      0.67       265



✓ COMPLETE: spatial_recognition → 67.5%


========================================================================
ALL EXPERIMENTS FINISHED
========================================================================

Final Results:
  object_detection        : 77.0%
  attribute_recognition   : 74.4%
  spatial_recognition     : 67.5%

  Average                 : 73.0%


========================================================================

 This problem is unconstrained.
 This problem is unconstrained.
 This problem is unconstrained.
RUNNING THE L-BFGS-B CODE

           * * *

Machine precision = 2.220D-16
 N =          4097     M =            10

At X0          0 variables are exactly at the bounds

At iterate    0    f=  6.93147D-01    |proj g|=  4.43761D-01

At iterate   50    f=  4.45194D-02    |proj g|=  2.33329D-04

           * * *

Tit   = total number of iterations
Tnf   = total number of function evaluations
Tnint = total number of segments explored during Cauchy searches
Skip  = number of BFGS updates skipped
Nact  = number of active bounds at final generalized Cauchy point
Projg = norm of the final projected gradient
F     = final function value

           * * *

   N    Tit     Tnf  Tnint  Skip  Nact     Projg        F
 4097    68      77      1     0     0   8.720D-05   4.404D-02
  F =    4.4039769353369423E-002

 CONVERGENCE: NORM_OF_PROJECTED_GRADIENT_<=_PGTOL
RUNNING THE L-BFGS-B CODE

           * * *

Machine precision = 2.220D-16
 N =          4097     M =            10
```

```
At X0            0 variables are exactly at the bounds

At iterate     0    f=  6.93147D-01    |proj g|=  3.09875D-01

At iterate    50    f=  9.62054D-02    |proj g|=  1.33228D-03

At iterate   100    f=  8.29658D-02    |proj g|=  4.11220D-04

            * * *

Tit   = total number of iterations
Tnf   = total number of function evaluations
Tnint = total number of segments explored during Cauchy searches
Skip  = number of BFGS updates skipped
Nact  = number of active bounds at final generalized Cauchy point
Projg = norm of the final projected gradient
F     = final function value

            * * *

   N    Tit     Tnf  Tnint  Skip  Nact     Projg         F
 4097   143     154      1     0     0   9.671D-05   8.208D-02
  F =    8.2084857257961663E-002

CONVERGENCE: NORM_OF_PROJECTED_GRADIENT_<=_PGTOL
RUNNING THE L-BFGS-B CODE

            * * *

Machine precision = 2.220D-16
 N =          4097     M =            10

At X0            0 variables are exactly at the bounds

At iterate     0    f=  6.93147D-01    |proj g|=  2.92495D-01

At iterate    50    f=  4.87329D-02    |proj g|=  2.99140D-04

            * * *

Tit   = total number of iterations
Tnf   = total number of function evaluations
Tnint = total number of segments explored during Cauchy searches
Skip  = number of BFGS updates skipped
Nact  = number of active bounds at final generalized Cauchy point
Projg = norm of the final projected gradient
F     = final function value

            * * *

   N    Tit     Tnf  Tnint  Skip  Nact     Projg         F
 4097    62      66      1     0     0   9.861D-05   4.851D-02
  F =    4.8506402762035994E-002

CONVERGENCE: NORM_OF_PROJECTED_GRADIENT_<=_PGTOL
=== Job finished at Wed Oct 22 22:48:15 CEST 2025 with exit code: 0 ===
```