GSEE Benchmark Standard Report

Report based on data from 2025-01-23T13:31:51.327173+00:00

https://github.com/isi-usc-edu/qb-gsee-benchmark

Input data: `Hamiltonian_features.csv`, last modified Mon Dec 30 16:29:03 2024

Input data: `GSEE-HC_utility_estimates_all_instances_task_uuids_v2.csv`, last modified Thu Jan 9 12:11:19 2025

Latest creation time for a `problem_instance.json` file: Wed Jan 22 17:01:13 2025

Latest creation time for a `performance_metrics.json` file: Thu Jan 23 08:33:05 2025

Latest creation time for a `solution.json` file: Wed Jan 22 16:55:50 2025

Problem Instance Summary Statistics

number of `problem_instances`: 82

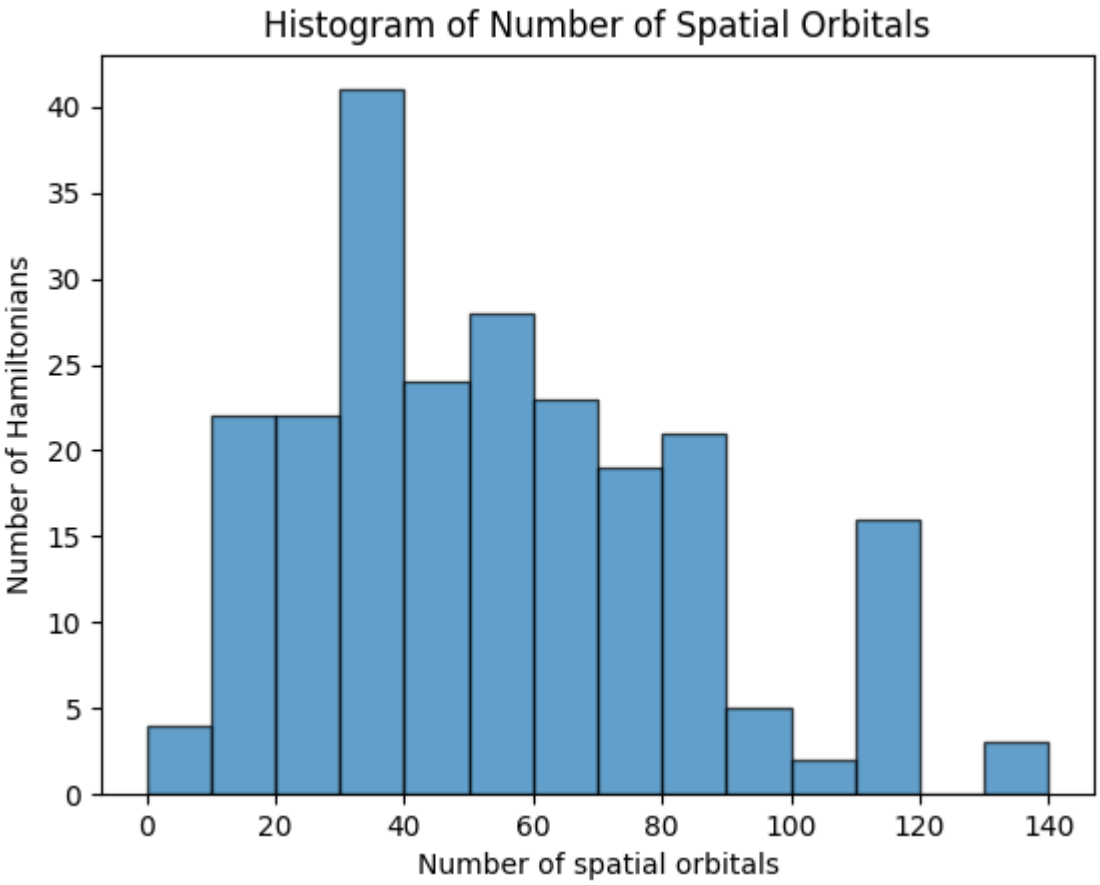
`problem_instance.json` with the most tasks: 30 (hubbard_square/614c4444-a31a-4348-b24d-01040208651c)

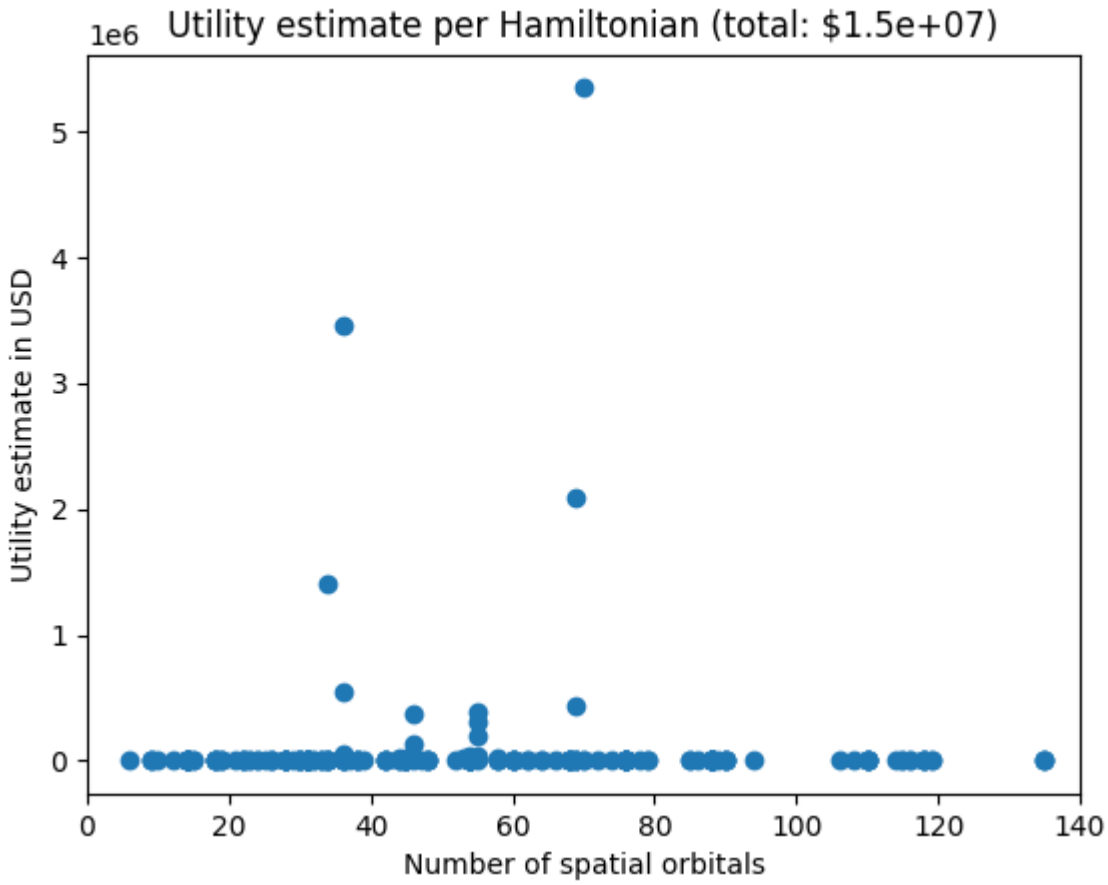
number of Hamiltonians (i.e., tasks): 230

minimum number of orbitals: 6

median number of orbitals: 53.5

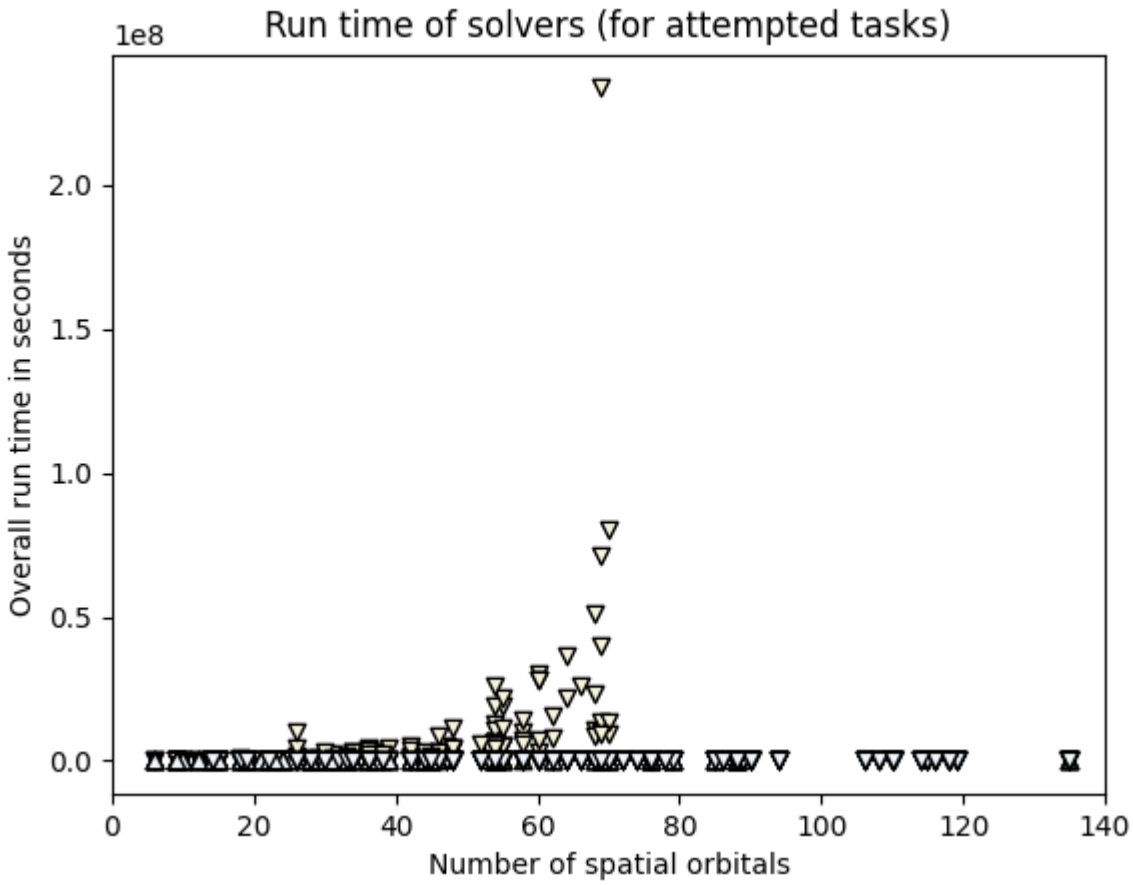
maximum number of orbitals: 135

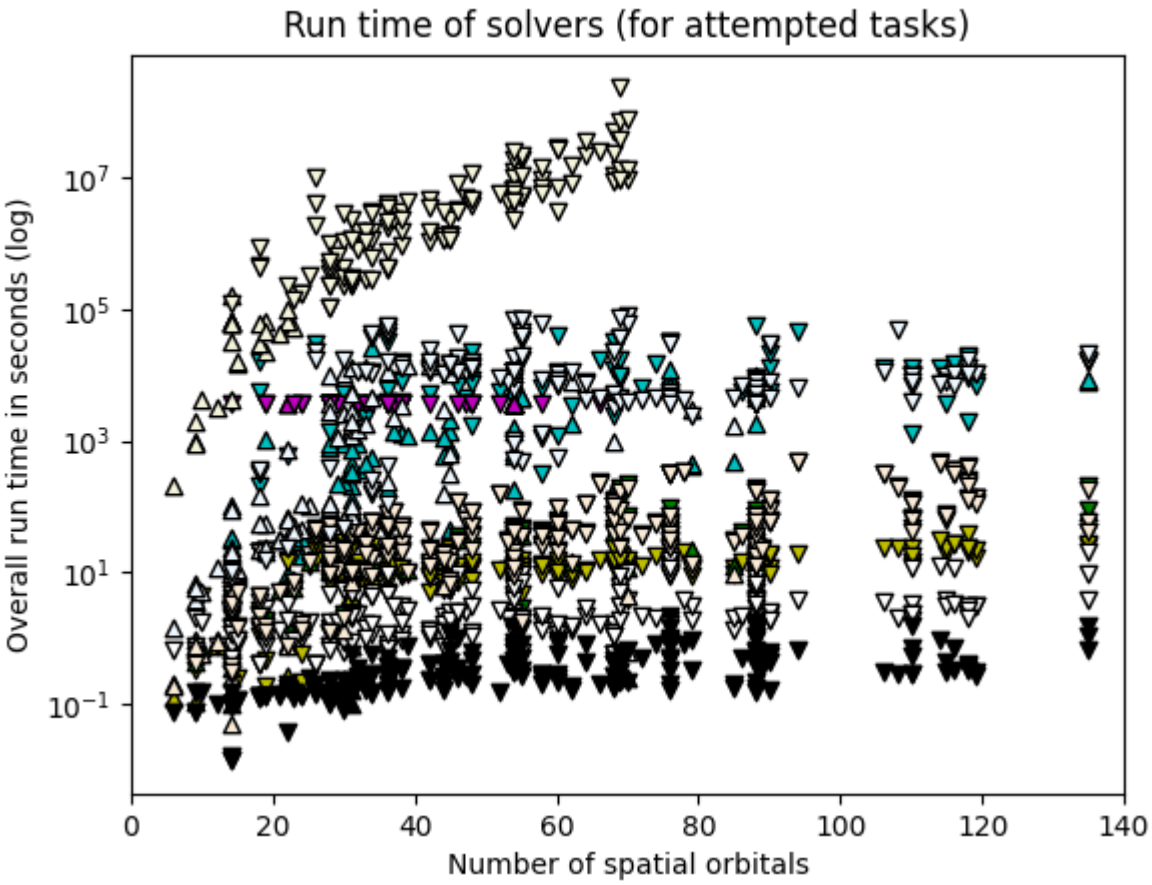

Histogram of Number of Spatial Orbitals
Number of Hamiltonians
Number of spatial orbitals
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140



Solver Summary Statistics

number of unique participating solvers: 9


Run time of solvers (for attempted tasks)
1e8
2.0
1.5
1.0
0.5
0.0
Overall run time in seconds
0
20
40
60
80
100
120
140
Number of spatial orbitals



Solver SHCI_opt, 2dde727e-a881-44fa-aabf-bba6248e4baf

solver_uuid:2dde727e-a881-44fa-aabf-bba6248e4baf

solver_short_name:SHCI_opt

compute_hardware_type:classical_computer

classical_hardware_details:{'computing_environment_name': 'LCRC Improv (per node)', 'cpu_description': '2x AMD EPYC 7713 64C', 'ram_available_gb': '256GB', 'clock_speed': '2 GHz', 'total_num_cores': 128}

algorithm_details:SHCI with optimized orbitals followed by SHCI+PT

software_details:SHCI Arrow Code (https://github.com/QMC-Cornell/shci).

performance_metrics_uuid: c6c10c13-6a0e-472d-a43f-0277ffc56606

creation_timestamp: 2025-01-23T13:31:51.327173+00:00

number_of_problem_instances: 82

number_of_problem_instances_attempted: 41

number_of_problem_instances_solved: 14

number_of_tasks: 230

number_of_tasks_attempted: 162

number_of_tasks_solved: 80

number_of_tasks_solved_within_run_time_limit: 162

number_of_tasks_solved_within_accuracy_threshold: 80

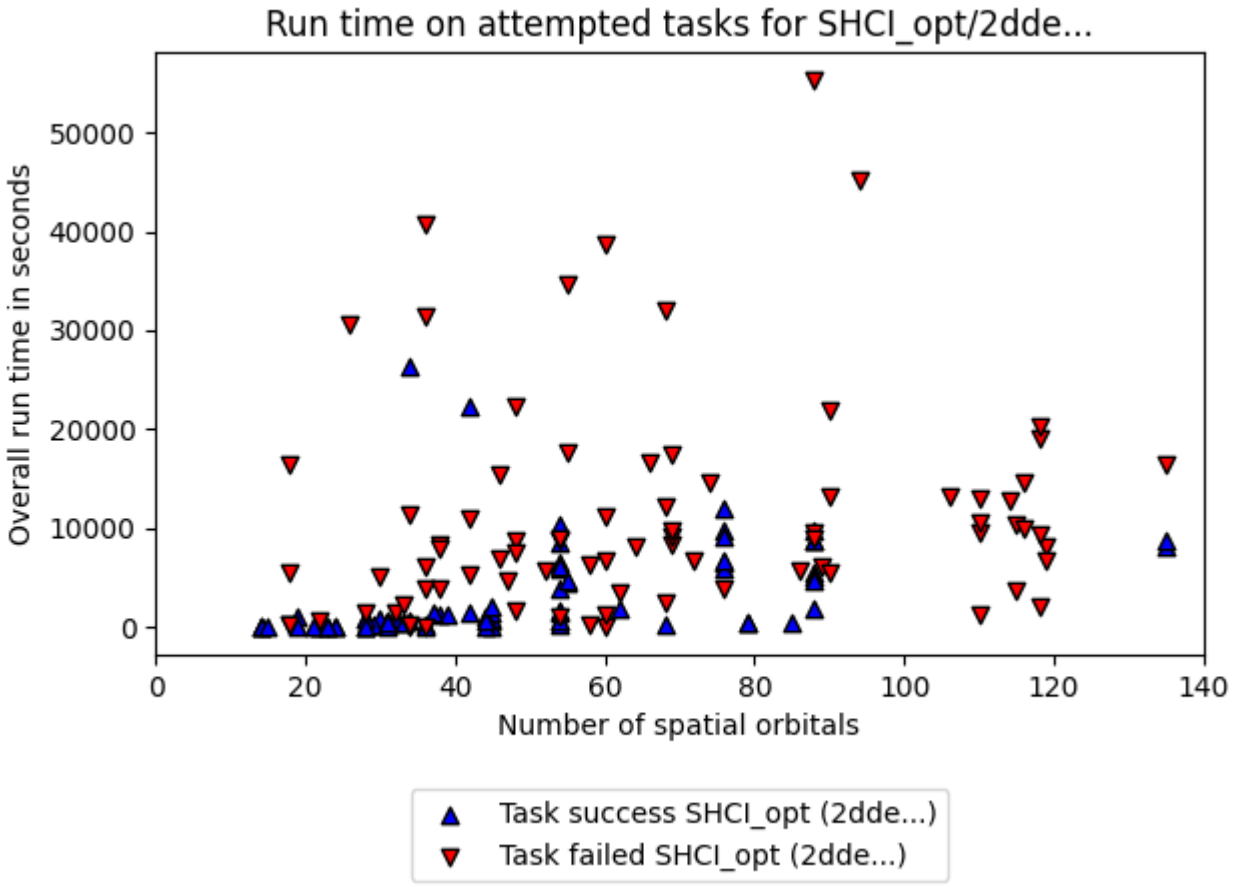
max_run_time_of_attempted_tasks: 55299.387

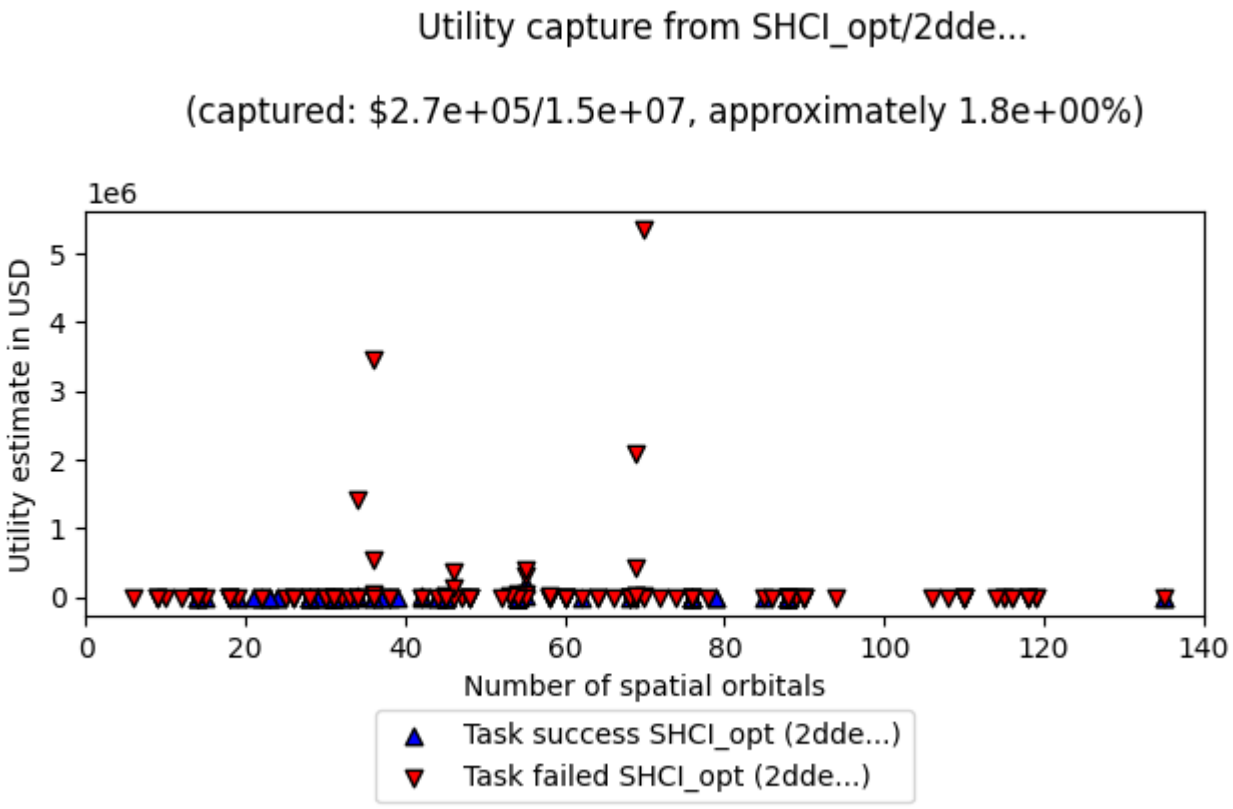
sum_of_run_time_of_attempted_tasks: 1138067.4269999997

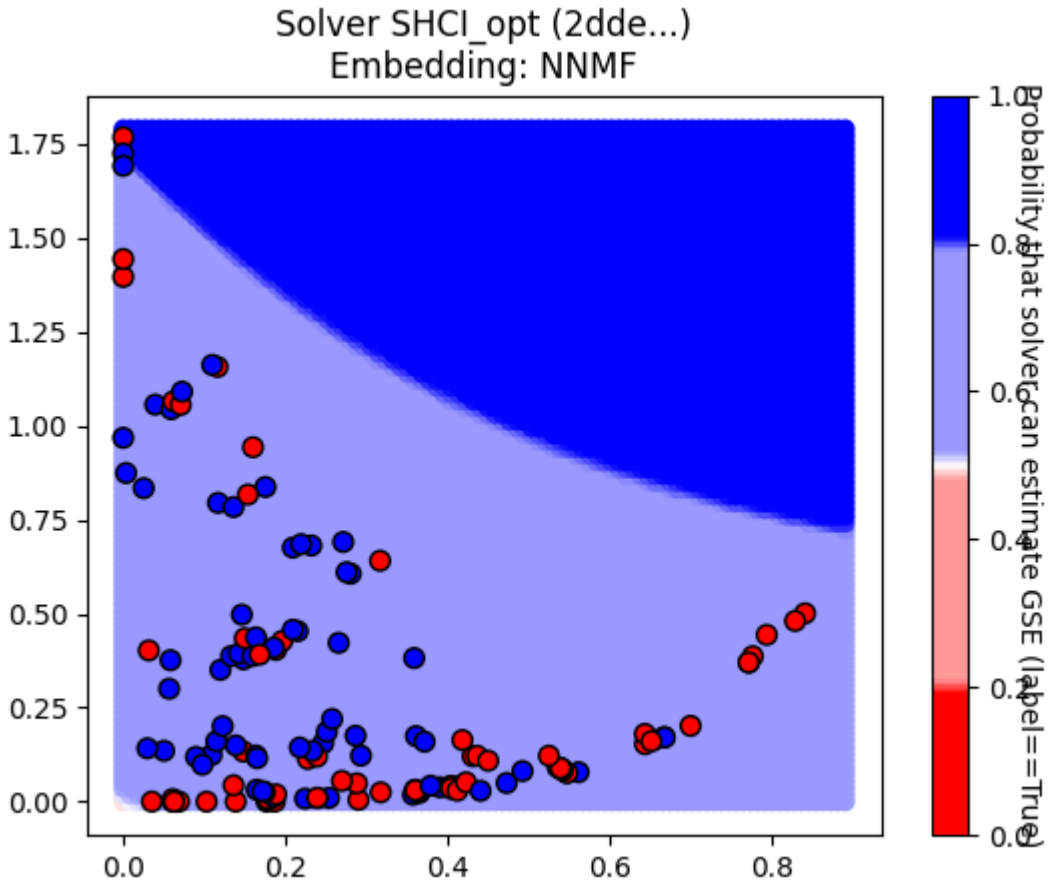
solvability_ratio: 0.9998

f1_score: [0.7058823529411765, 0.8275862068965517]

ml_metrics_calculator_version: 1




Utility capture from SHCI_opt/2dde...
(captured: $2.7e+05/1.5e+07, approximately 1.8e+00%)
1e6
Utility estimate in USD
Number of spatial orbitals
Task success SHCI_opt (2dde...)
Task failed SHCI_opt (2dde...)



SHAP summary plot

Solver CCSDT_PLACEHOLDER, fd13c864-baf1-44de-b52d-0e5dd69f647a

solver_uuid:fd13c864-baf1-44de-b52d-0e5dd69f647a

solver_short_name:CCSDT_PLACEHOLDER

compute_hardware_type:classical_computer

classical_hardware_details:{'cpu_description': 'CCSDT_PLACEHOLDER_cpu_description'}

algorithm_details:CCSDT_PLACEHOLDER_algorithm_details

software_details:CCSDT_PLACEHOLDER_software_details

performance_metrics_uuid: 119b53fd-0fc6-4b04-a228-20c5fcfed8fd

creation_timestamp: 2025-01-23T13:31:51.327173+00:00

number_of_problem_instances: 82

number_of_problem_instances_attempted: 4

number_of_problem_instances_solved: 0

number_of_tasks: 230

number_of_tasks_attempted: 53

number_of_tasks_solved: 16

number_of_tasks_solved_within_run_time_limit: 53

number_of_tasks_solved_within_accuracy_threshold: 16

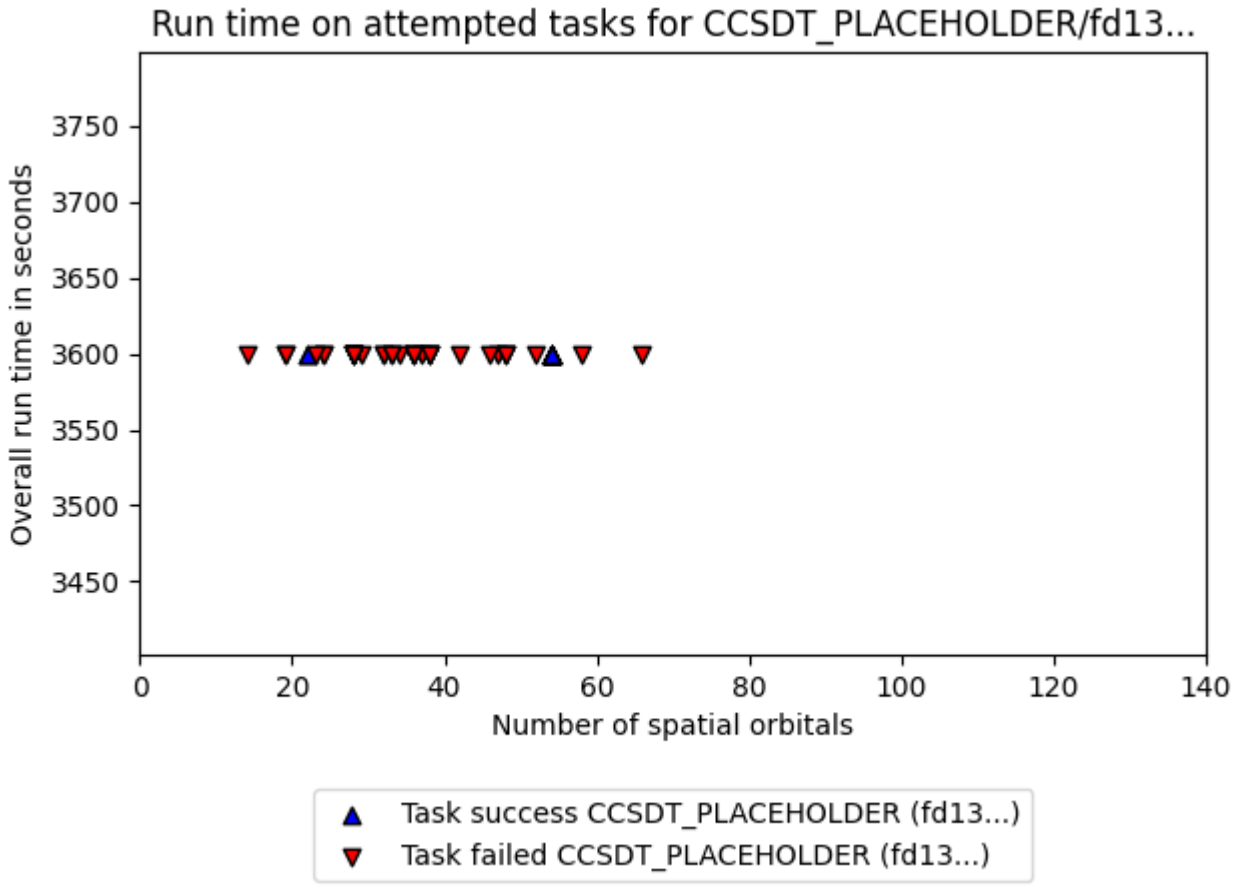
max_run_time_of_attempted_tasks: 3600.0

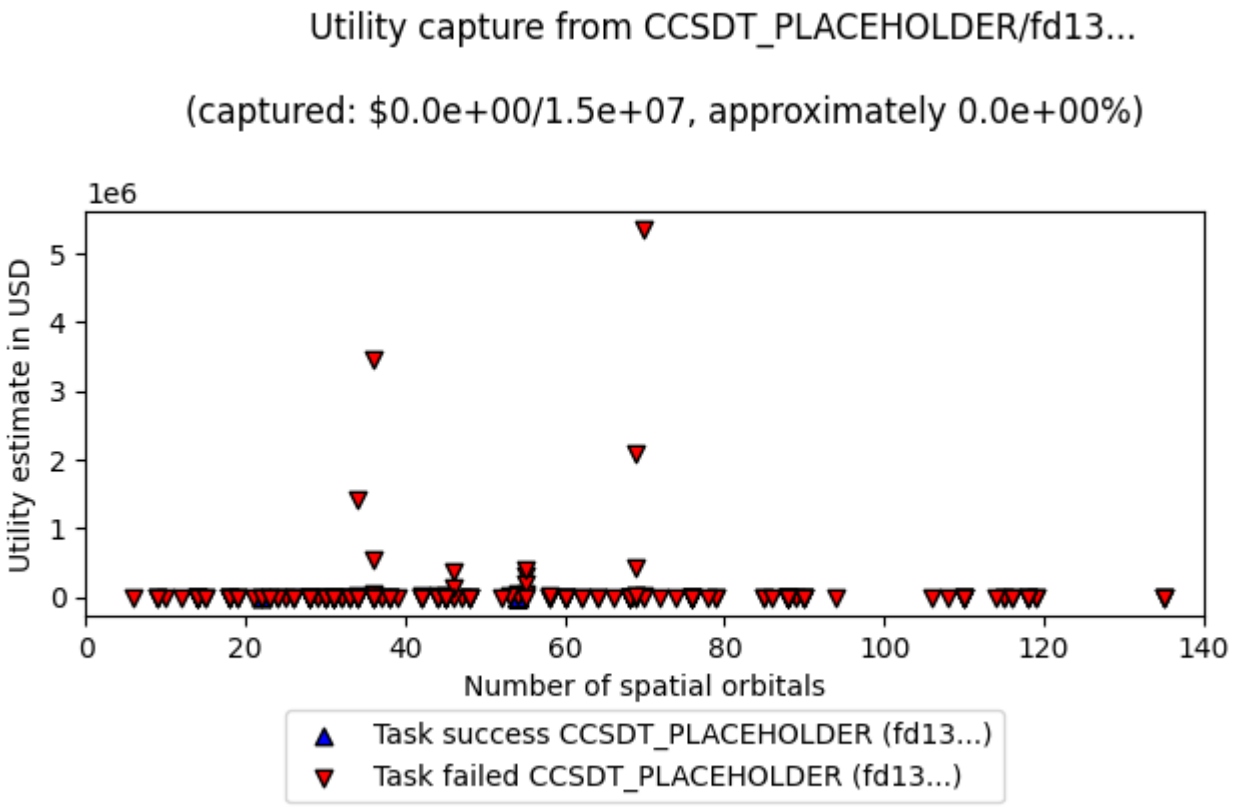
sum_of_run_time_of_attempted_tasks: 190800.0

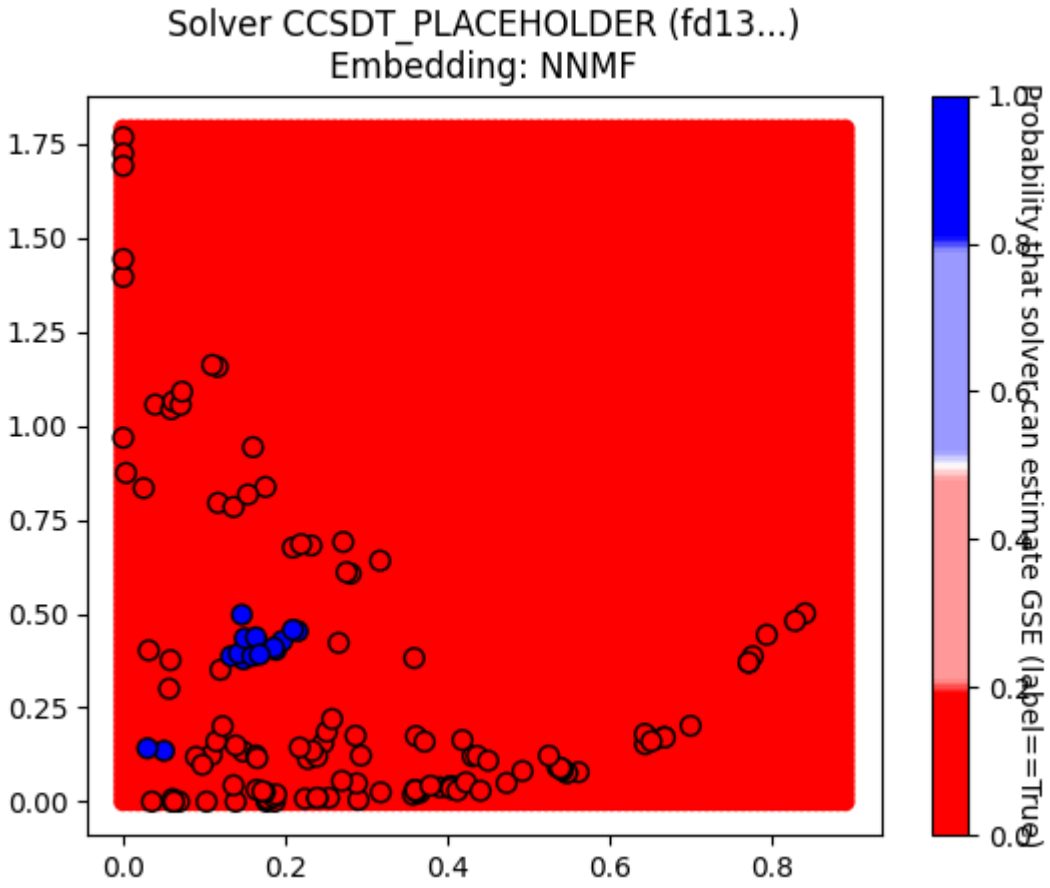
solvability_ratio: 0.0

f1_score: [0.9878542510121457, 0.896551724137931]

ml_metrics_calculator_version: 1




Utility capture from CCSDT_PLACEHOLDER/fd13...
(captured: $0.0e+00/1.5e+07, approximately 0.0e+00%)
1e6
Utility estimate in USD
Number of spatial orbitals
Task success CCSDT_PLACEHOLDER (fd13...)
Task failed CCSDT_PLACEHOLDER (fd13...)



SHAP summary plot

Solver CISD, 418f060e-496b-4024-8d2d-9b1f8791e76d

solver_uuid:418f060e-496b-4024-8d2d-9b1f8791e76d

solver_short_name:CISD

compute_hardware_type:classical_computer

classical_hardware_details:{'computing_environment_name': 'LCRC Improv (per node)', 'cpu_description': '2x AMD EPYC 7713 64C', 'ram_available_gb': '256GB', 'clock_speed': '2 GHz', 'total_num_cores': 128}

algorithm_details:CISD

software_details:pyscf (https://github.com/pyscf/pyscf).

performance_metrics_uuid: f03ff937-5491-4f24-a4fc-6f6b76ee10f4

creation_timestamp: 2025-01-23T13:31:51.327173+00:00

number_of_problem_instances: 82

number_of_problem_instances_attempted: 82

number_of_problem_instances_solved: 9

number_of_tasks: 230

number_of_tasks_attempted: 230

number_of_tasks_solved: 14

number_of_tasks_solved_within_run_time_limit: 230

number_of_tasks_solved_within_accuracy_threshold: 14

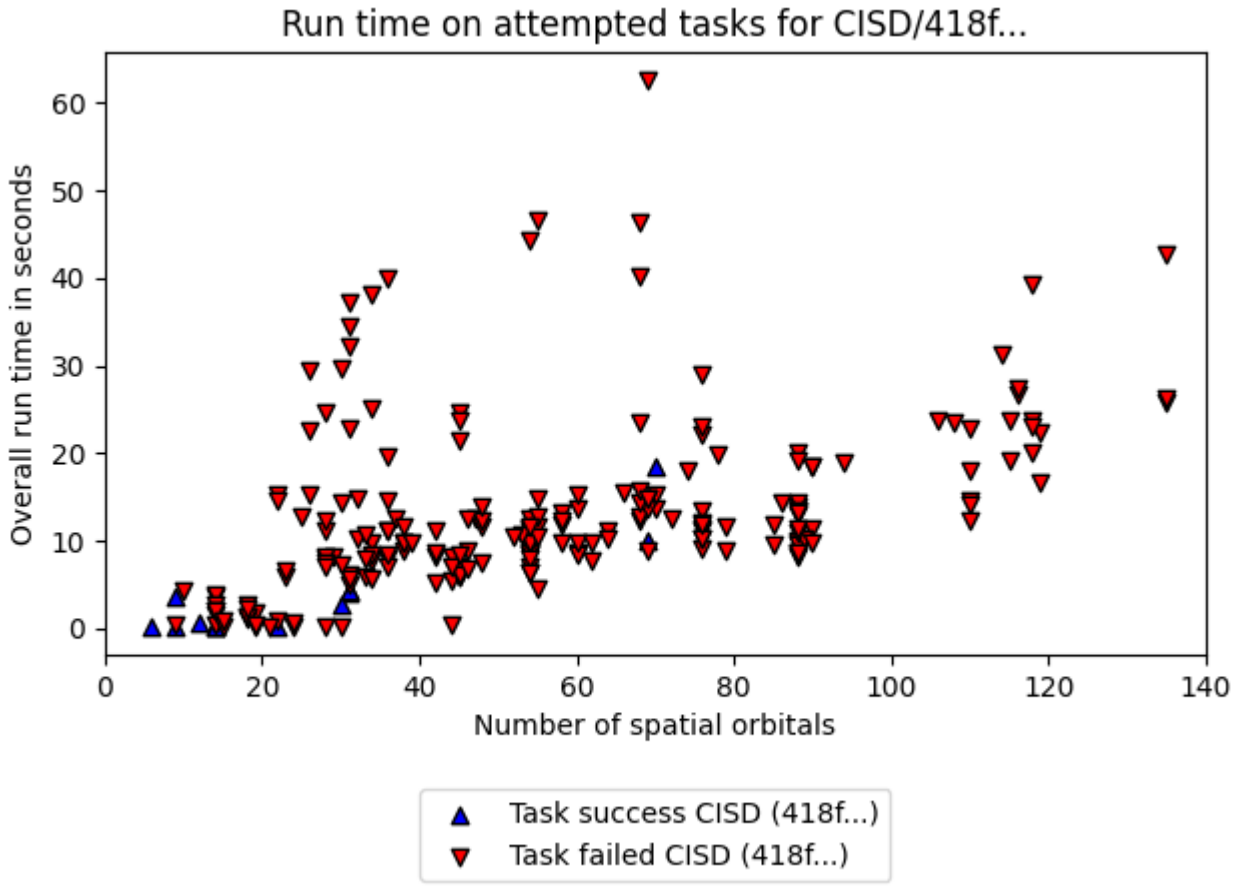
max_run_time_of_attempted_tasks: 62.58296537399292

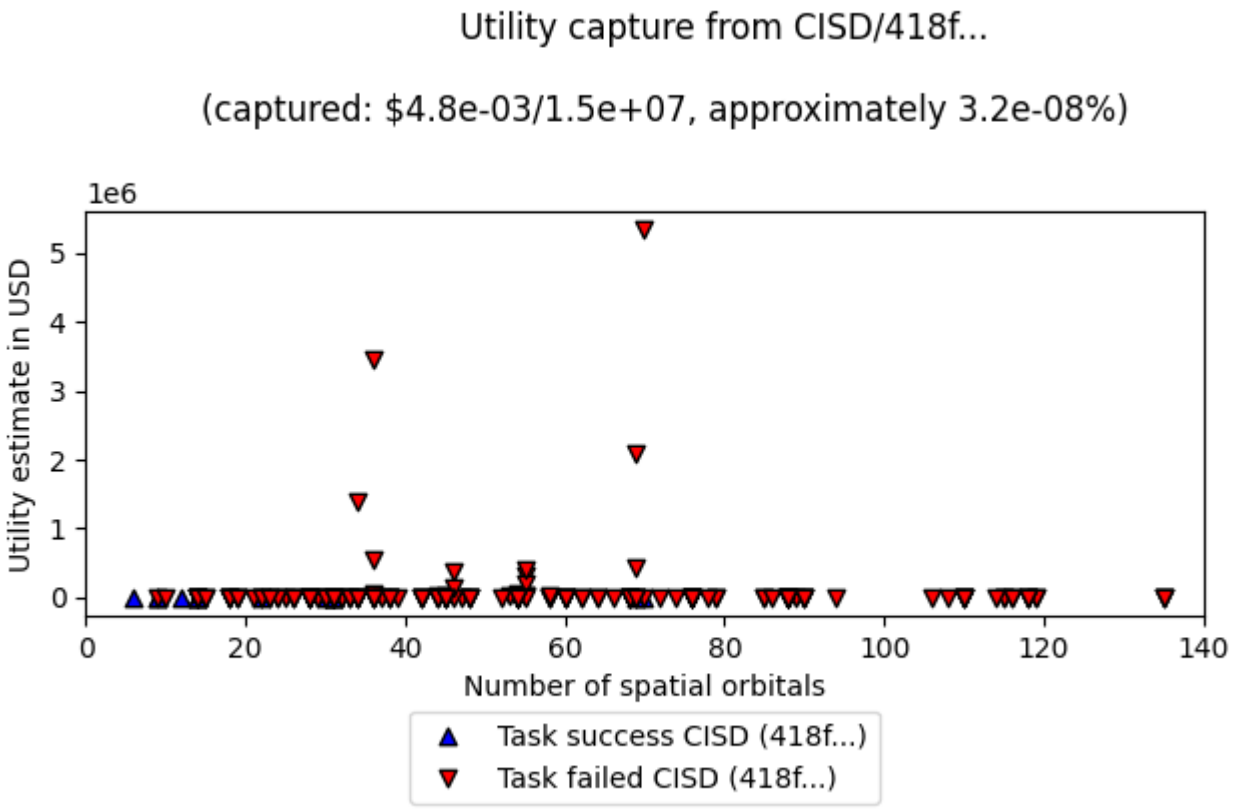
sum_of_run_time_of_attempted_tasks: 2895.8530027866364

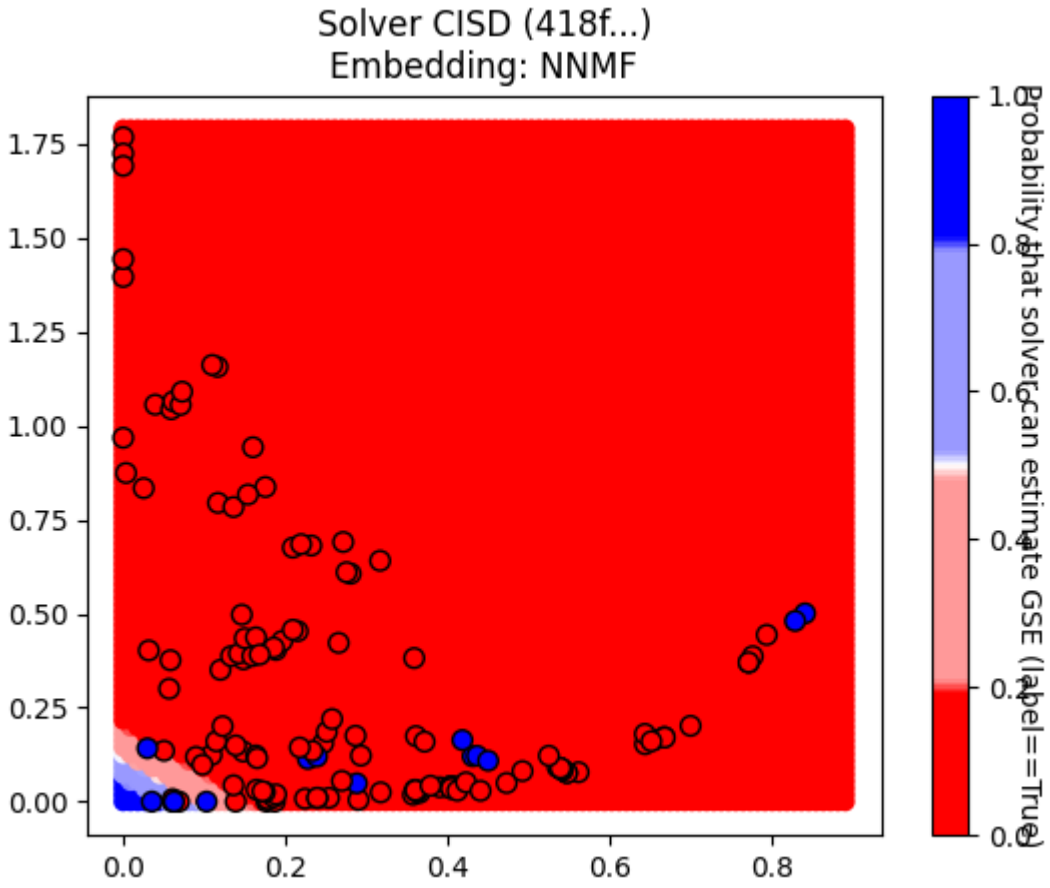
solvability_ratio: 0.0047

f1_score: [0.9919354838709677, 0.9285714285714286]

ml_metrics_calculator_version: 1




Utility capture from CISD/418f...
(captured: $4.8e-03/1.5e+07, approximately 3.2e-08%)
1e6
Utility estimate in USD
Number of spatial orbitals
Task success CISD (418f...)
Task failed CISD (418f...)



SHAP summary plot

Solver CCSD(T), c09217e6-d0f7-4b0f-81c4-79210b7ac878

solver_uuid:c09217e6-d0f7-4b0f-81c4-79210b7ac878

solver_short_name:CCSD(T)

compute_hardware_type:classical_computer

classical_hardware_details:{'computing_environment_name': 'LCRC Improv (per node)', 'cpu_description': '2x AMD EPYC 7713 64C', 'ram_available_gb': '256GB', 'clock_speed': '2 GHz', 'total_num_cores': 128}

algorithm_details:CCSD(T)

software_details:pyscf (https://github.com/pyscf/pyscf).

performance_metrics_uuid: b9b1938e-a4da-4c2f-afa1-65e41c184f95

creation_timestamp: 2025-01-23T13:31:51.327173+00:00

number_of_problem_instances: 82

number_of_problem_instances_attempted: 78

number_of_problem_instances_solved: 19

number_of_tasks: 230

number_of_tasks_attempted: 221

number_of_tasks_solved: 64

number_of_tasks_solved_within_run_time_limit: 221

number_of_tasks_solved_within_accuracy_threshold: 64

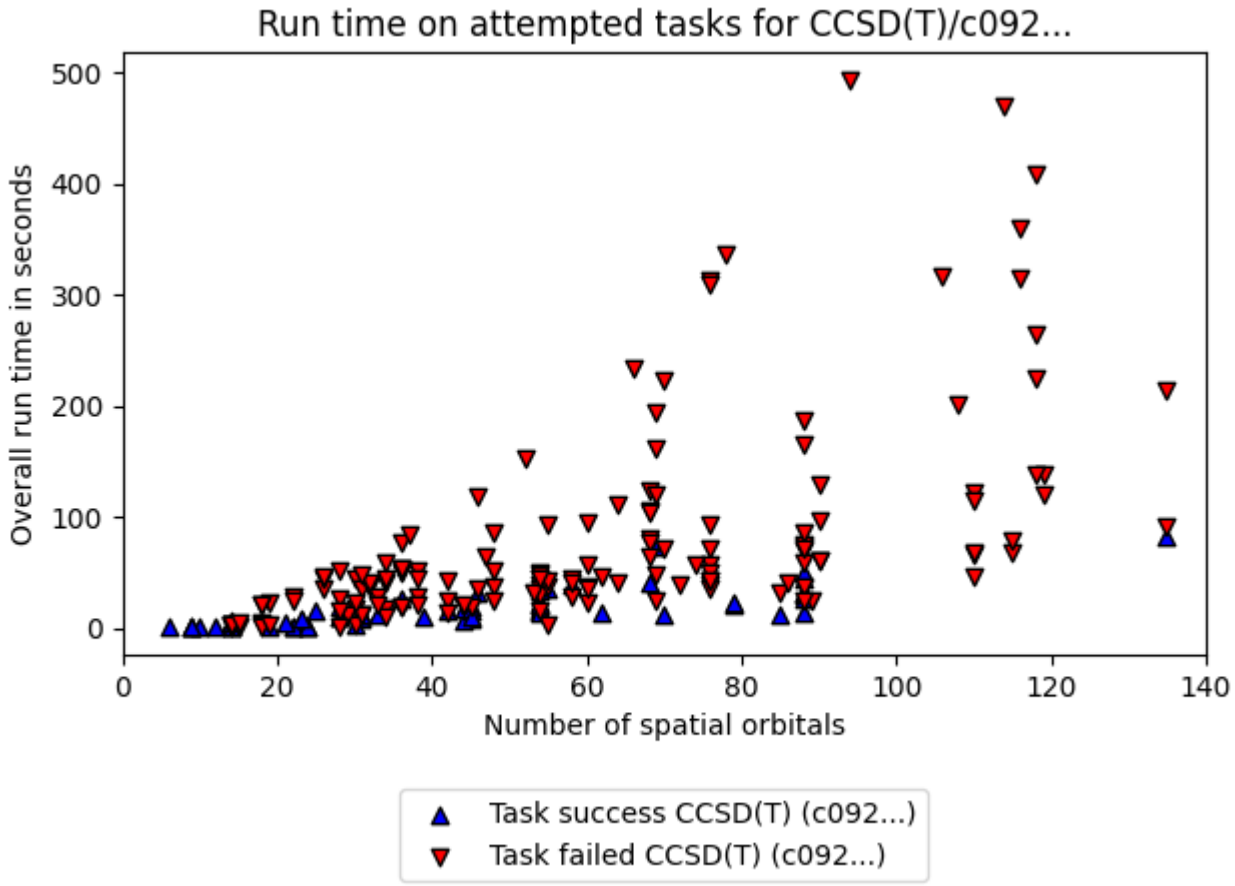
max_run_time_of_attempted_tasks: 493.4080808162689

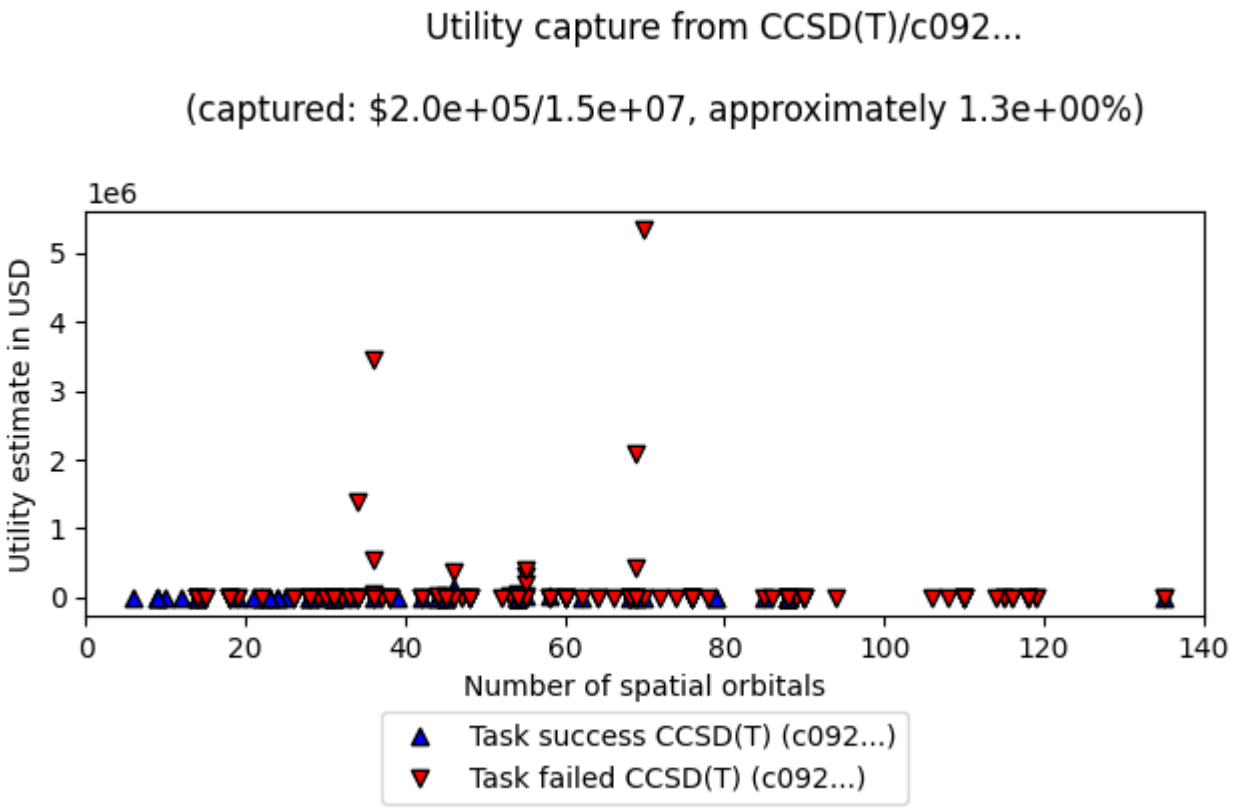
sum_of_run_time_of_attempted_tasks: 12968.4871737957

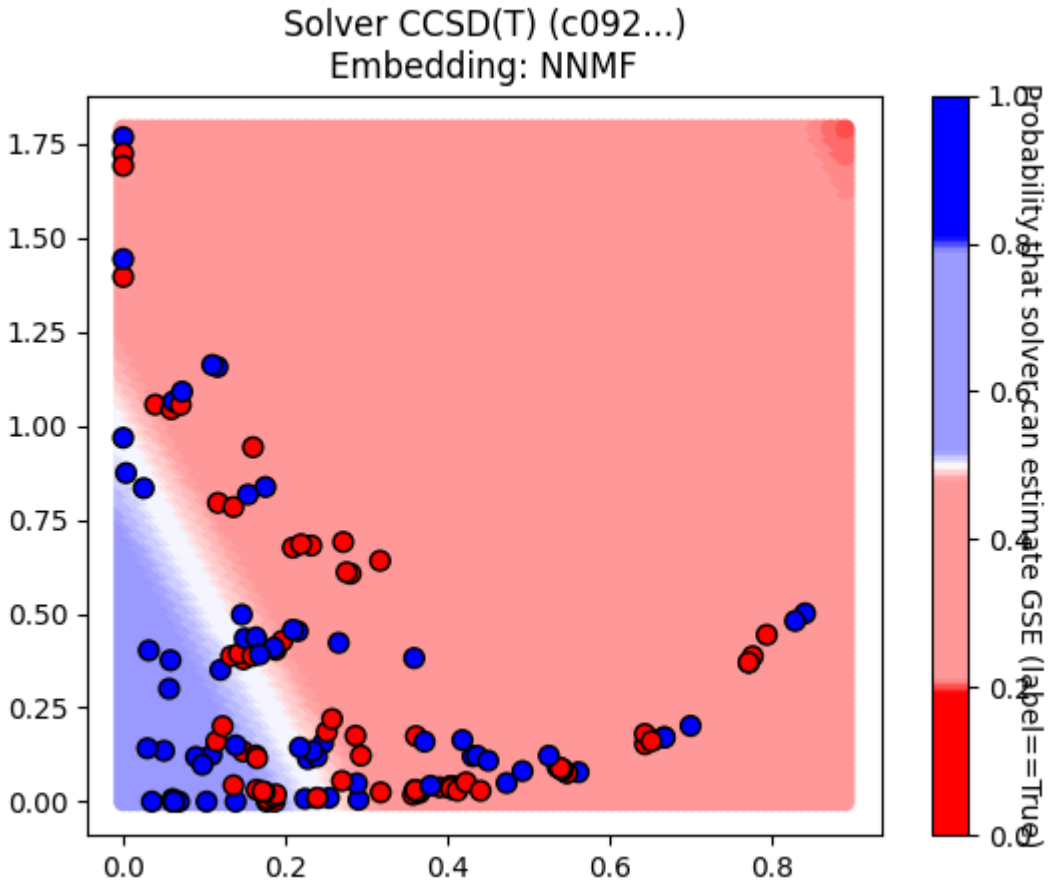
solvability_ratio: 0.0715

f1_score: [0.759493670886076, 0.6779661016949152]

ml_metrics_calculator_version: 1




Utility capture from CCSD(T)/c092...
(captured: $2.0e+05/1.5e+07, approximately 1.3e+00%)
1e6
Utility estimate in USD
Number of spatial orbitals
Task success CCSD(T) (c092...)
Task failed CCSD(T) (c092...)



SHAP summary plot

Solver HF, 5f5e617a-19c2-4d82-bebc-b2d6b3dcb012

solver_uuid:5f5e617a-19c2-4d82-bebc-b2d6b3dcb012

solver_short_name:HF

compute_hardware_type:classical_computer

classical_hardware_details:{'computing_environment_name': 'LCRC Improv (per node)', 'cpu_description': '2x AMD EPYC 7713 64C', 'ram_available_gb': '256GB', 'clock_speed': '2 GHz', 'total_num_cores': 128}

algorithm_details:Hartree Fock

software_details:pyscf (https://github.com/pyscf/pyscf).

performance_metrics_uuid: 500f9a10-5888-4c77-a857-a18f63e3cd07

creation_timestamp: 2025-01-23T13:31:51.327173+00:00

number_of_problem_instances: 82

number_of_problem_instances_attempted: 82

number_of_problem_instances_solved: 5

number_of_tasks: 230

number_of_tasks_attempted: 230

number_of_tasks_solved: 5

number_of_tasks_solved_within_run_time_limit: 230

number_of_tasks_solved_within_accuracy_threshold: 5

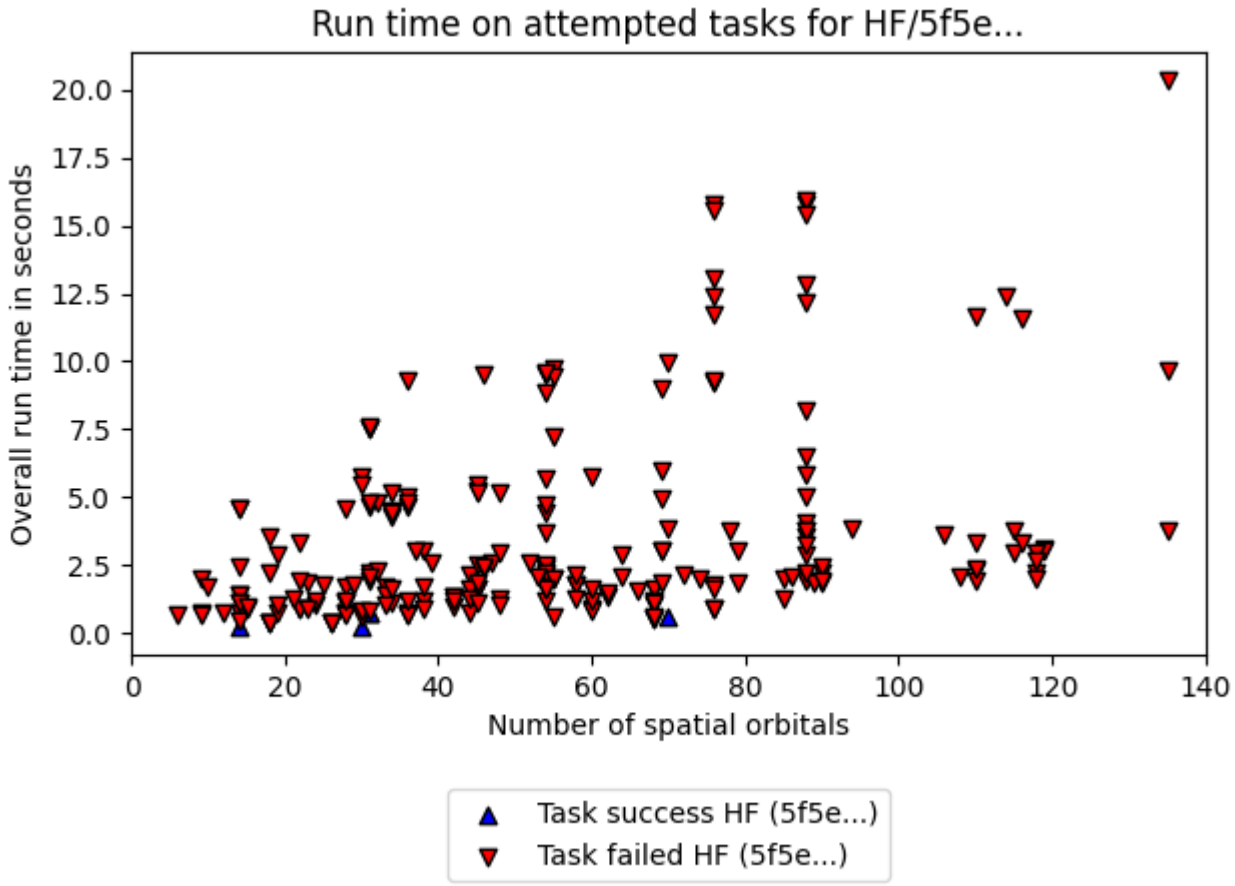
max_run_time_of_attempted_tasks: 20.338801622390747

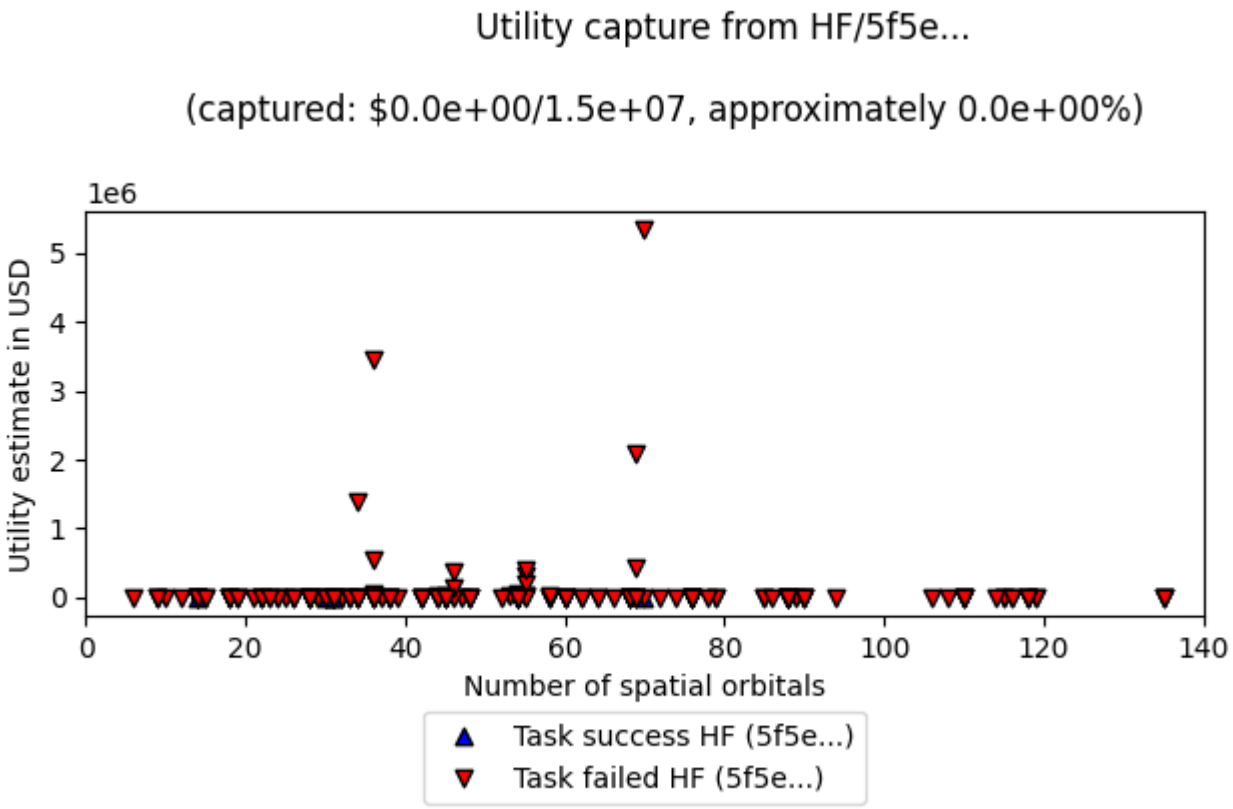
sum_of_run_time_of_attempted_tasks: 792.8028435707092

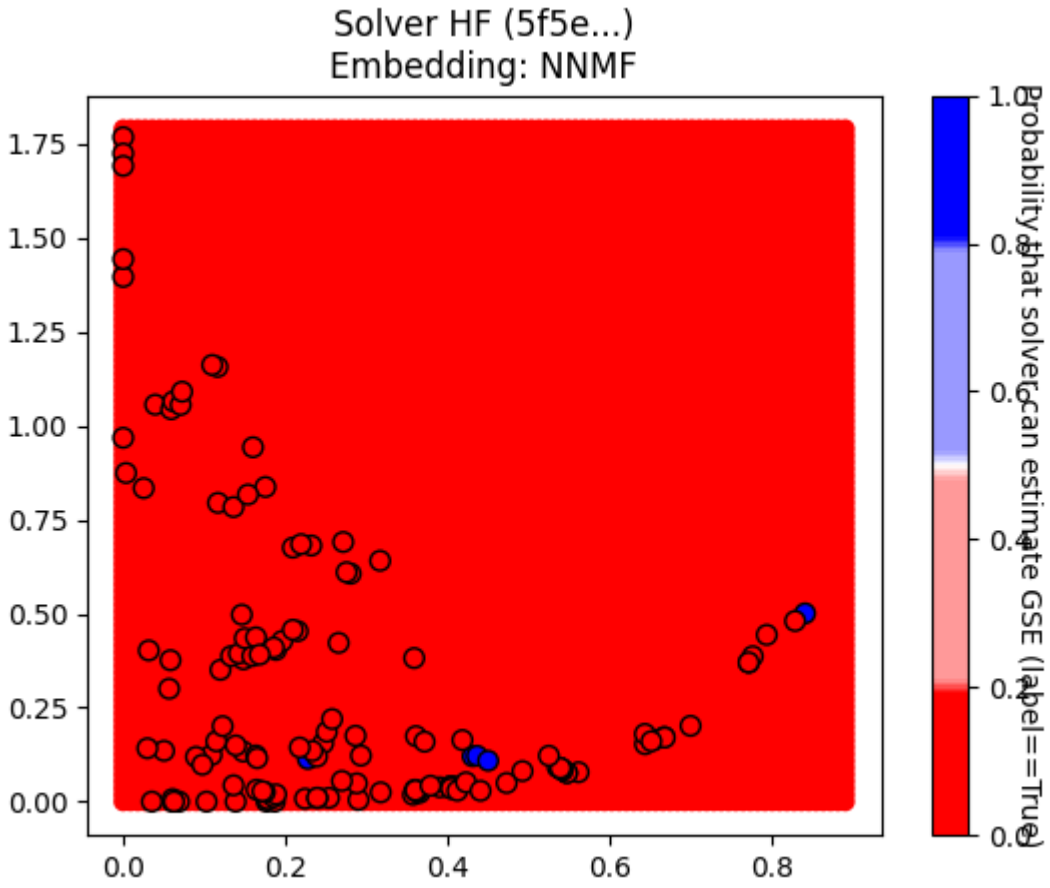
solvability_ratio: 0.0

f1_score: [0.9847328244274809, 0.7142857142857143]

ml_metrics_calculator_version: 1




Utility capture from HF/5f5e...
(captured: $0.0e+00/1.5e+07, approximately 0.0e+00%)
1e6
Utility estimate in USD
Number of spatial orbitals
Task success HF (5f5e...)
Task failed HF (5f5e...)



SHAP summary plot

Solver MP2, b420358b-5def-41e6-8c5d-b9d93b6aecd2

solver_uuid:b420358b-5def-41e6-8c5d-b9d93b6aecd2

solver_short_name:MP2

compute_hardware_type:classical_computer

classical_hardware_details:{'computing_environment_name': 'LCRC Improv (per node)', 'cpu_description': '2x AMD EPYC 7713 64C', 'ram_available_gb': '256GB', 'clock_speed': '2 GHz', 'total_num_cores': 128}

algorithm_details:MP2

software_details:pyscf (https://github.com/pyscf/pyscf).

performance_metrics_uuid: f23f8d17-0587-46f6-9520-87714f67c1e1

creation_timestamp: 2025-01-23T13:31:51.327173+00:00

number_of_problem_instances: 82

number_of_problem_instances_attempted: 79

number_of_problem_instances_solved: 5

number_of_tasks: 230

number_of_tasks_attempted: 222

number_of_tasks_solved: 5

number_of_tasks_solved_within_run_time_limit: 222

number_of_tasks_solved_within_accuracy_threshold: 5

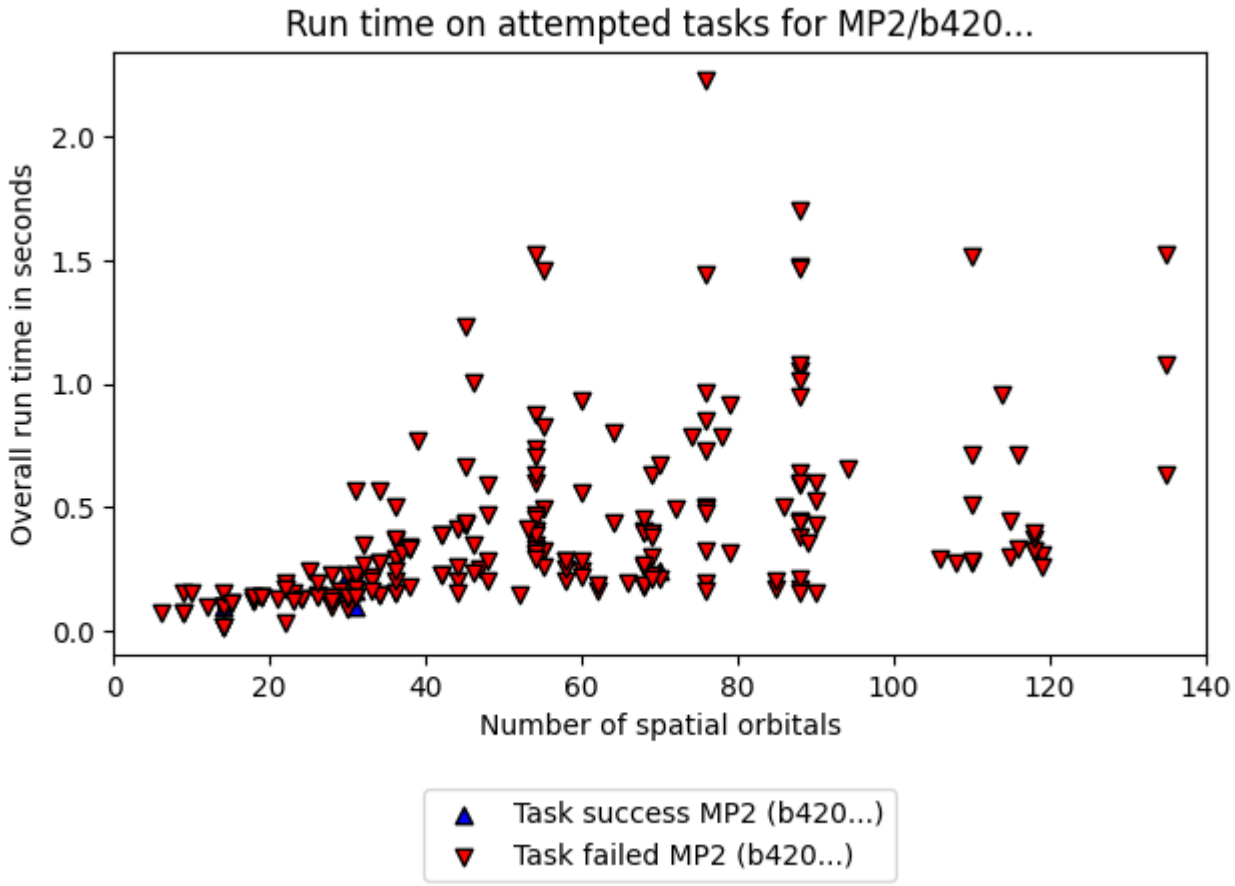
max_run_time_of_attempted_tasks: 2.230440139770508

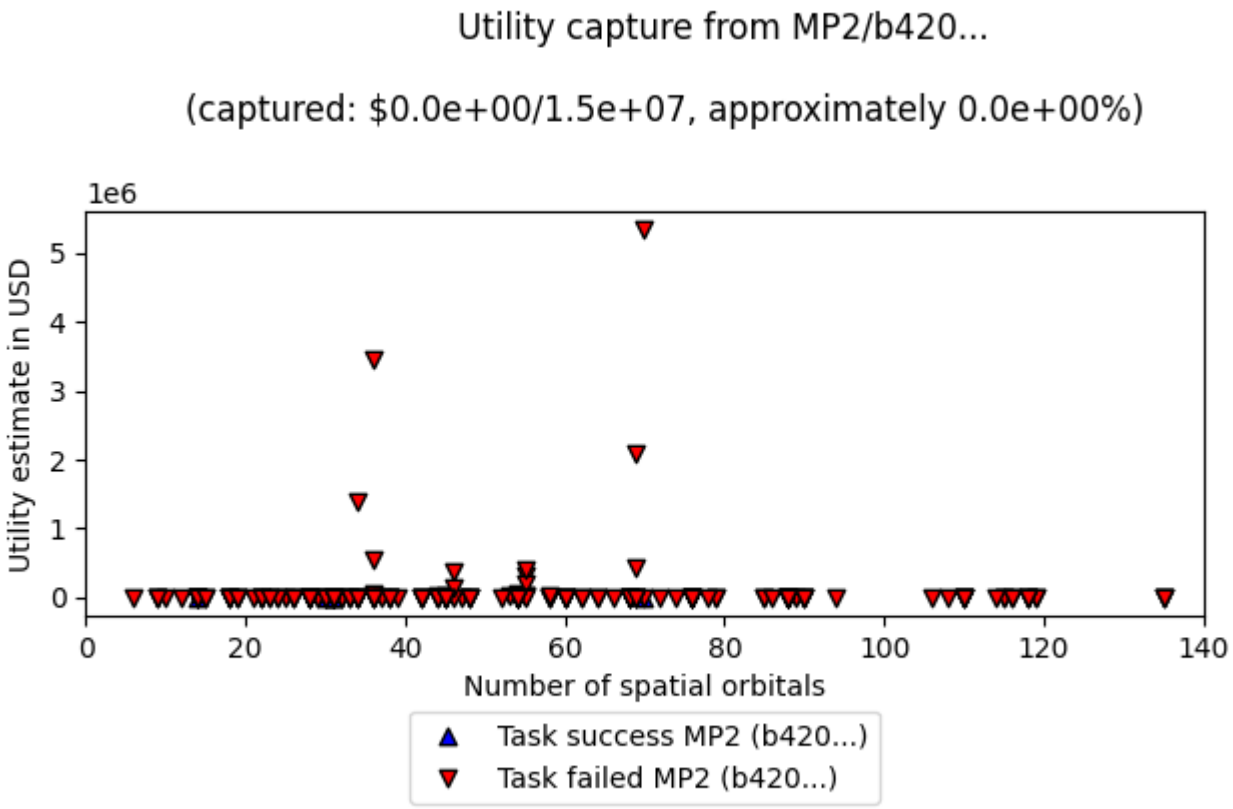
sum_of_run_time_of_attempted_tasks: 87.6544258594513

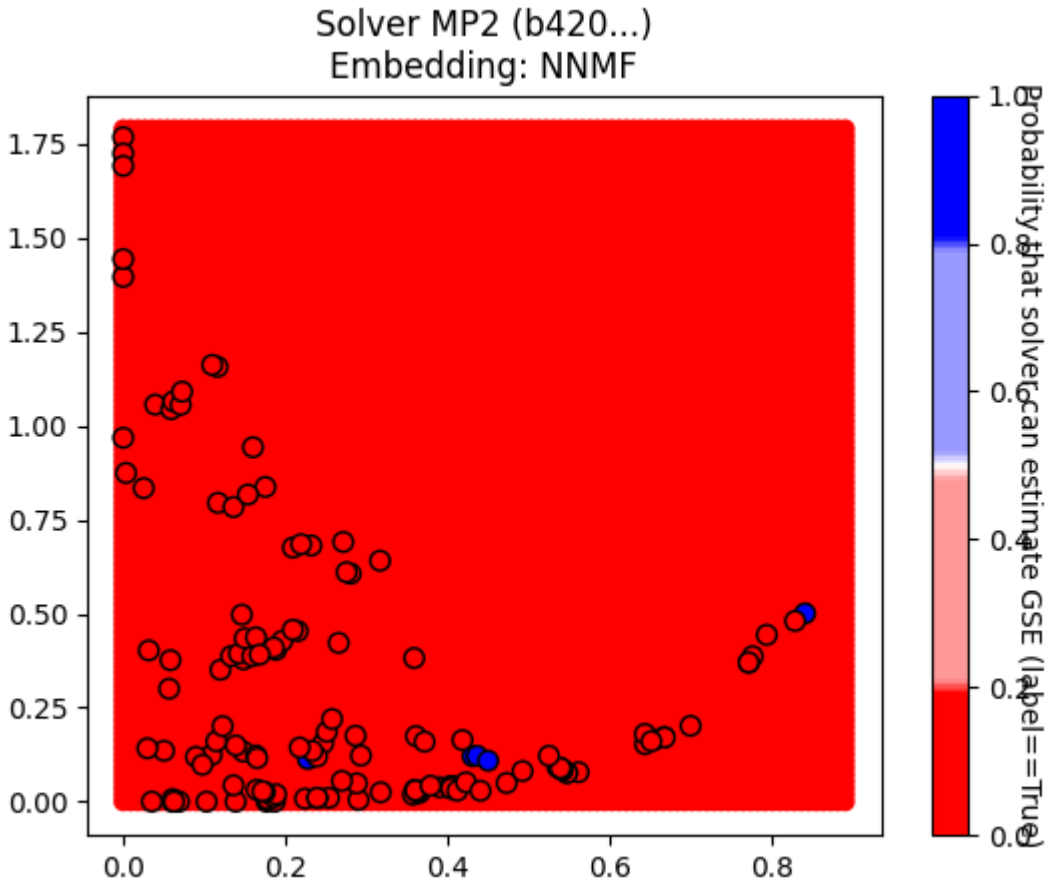
solvability_ratio: 0.0

f1_score: [0.9847328244274809, 0.7142857142857143]

ml_metrics_calculator_version: 1




Utility capture from MP2/b420...
(captured: $0.0e+00/1.5e+07, approximately 0.0e+00%)
1e6
Utility estimate in USD
Number of spatial orbitals
Task success MP2 (b420...)
Task failed MP2 (b420...)



SHAP summary plot

Solver CCSD, 0a29e54f-bef9-4d19-bafa-d94b1c4b37aa

solver_uuid:0a29e54f-bef9-4d19-bafa-d94b1c4b37aa

solver_short_name:CCSD

compute_hardware_type:classical_computer

classical_hardware_details:{'computing_environment_name': 'LCRC Improv (per node)', 'cpu_description': '2x AMD EPYC 7713 64C', 'ram_available_gb': '256GB', 'clock_speed': '2 GHz', 'total_num_cores': 128}

algorithm_details:CCSD

software_details:pyscf (https://github.com/pyscf/pyscf).

performance_metrics_uuid: 7aed8d7f-da42-4e5c-892a-055cb567d768

creation_timestamp: 2025-01-23T13:31:51.327173+00:00

number_of_problem_instances: 82

number_of_problem_instances_attempted: 78

number_of_problem_instances_solved: 9

number_of_tasks: 230

number_of_tasks_attempted: 221

number_of_tasks_solved: 17

number_of_tasks_solved_within_run_time_limit: 221

number_of_tasks_solved_within_accuracy_threshold: 17

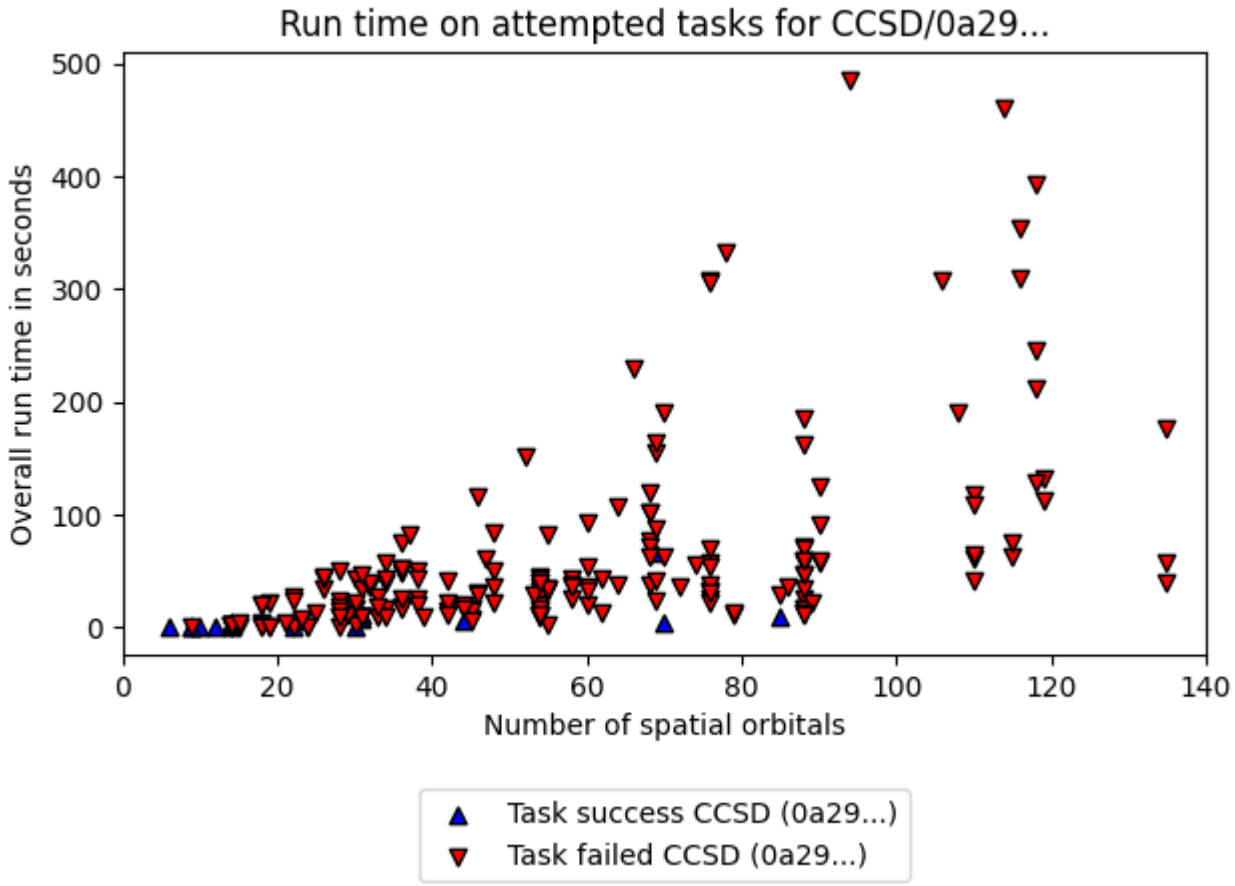
max_run_time_of_attempted_tasks: 485.1982181072235

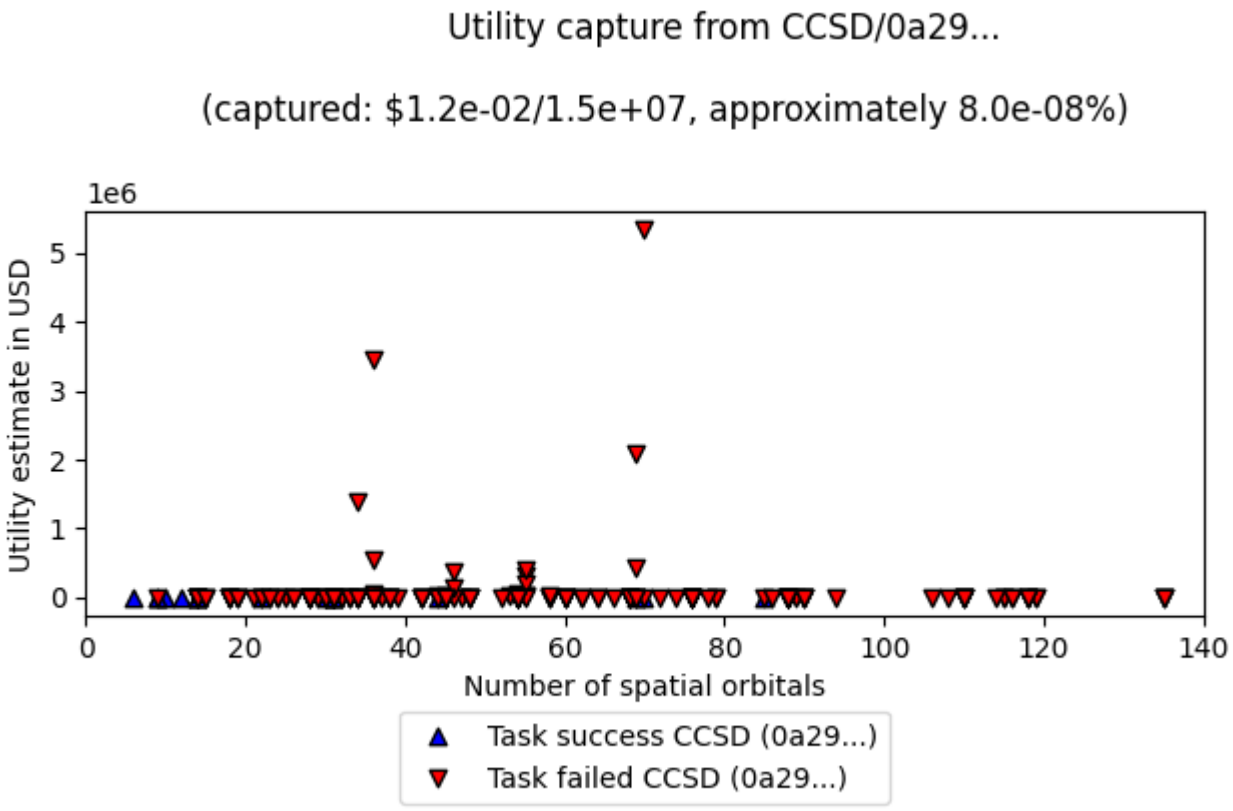
sum_of_run_time_of_attempted_tasks: 12029.76450586319

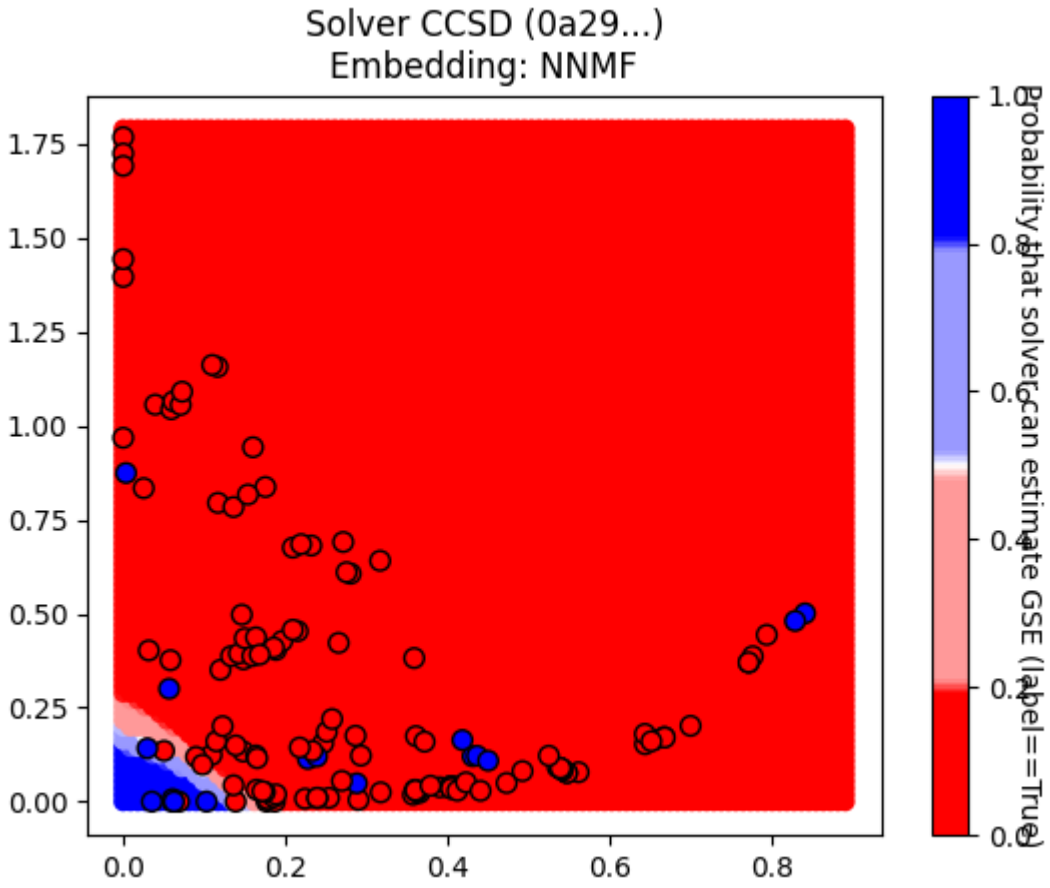
solvability_ratio: 0.0122

f1_score: [0.995850622406639, 0.9714285714285714]

ml_metrics_calculator_version: 1




Utility capture from CCSD/0a29...
(captured: $1.2e-02/1.5e+07, approximately 8.0e-08%)
1e6
Utility estimate in USD
Number of spatial orbitals
Task success CCSD (0a29...)
Task failed CCSD (0a29...)



SHAP summary plot

Solver DF_QPE, 5dad4064-cd11-412f-85cb-d722afe3b3de

solver_uuid:5dad4064-cd11-412f-85cb-d722afe3b3de

solver_short_name:DF_QPE

compute_hardware_type:quantum_computer

algorithm_details:{'algorithm_description': 'Double factorized QPE resource estimates based on methodology of arXiv:2406.06335. Note that the truncation error is not included in the error bounds and that the SCF compute time is not included in the preprocessing time. Ground-state overlap is taken to be that estimated for the dominant CSF as estimated by DMRG and that this DMRG runtime is not included in the classical compute costs.', 'algorithm_parameters': {'overlap_csv': 'overlaps.csv', 'sf_threshold': 1e-12, 'df_threshold': 0.001, 'max_orbitals': 70}}

software_details:[{'software_name': 'pyLIQTR', 'software_version': '1.2.1'}, {'software_name': 'qb-gsee-benchmark', 'software_version': '0.1.0a2.dev71+g5d9efab.d20241230'}, {'software_name': 'Python',

'software_version': '3.10.12 (main, Nov 6 2024, 20:22:13) [GCC 11.4.0]'}, {'software_name': 'qualtran', 'software_version': '0.2.0'}]

quantum_hardware_details:{'quantum_hardware_description': 'Optimistic superconducting hardware model based on that described in https://arxiv.org/abs/2011.03494.', 'quantum_hardware_parameters': {'num_factories': 4, 'physical_error_rate': 0.0001, 'cycle_time_microseconds': 1}}

logical_resource_estimate_solution_uuid:72dea71b-fb03-43f0-8086-eb37605ba3db

logical_resource_estimate_solver_uuid:f2d73e1f-3058-43c4-a634-b6c267c84ff1

performance_metrics_uuid: f1e54230-1575-45d7-b088-98d7bac97c61

creation_timestamp: 2025-01-23T13:31:51.327173+00:00

number_of_problem_instances: 82

number_of_problem_instances_attempted: 24

number_of_problem_instances_solved: 3

number_of_tasks: 230

number_of_tasks_attempted: 163

number_of_tasks_solved: 26

number_of_tasks_solved_within_run_time_limit: 26

number_of_tasks_solved_within_accuracy_threshold: 163

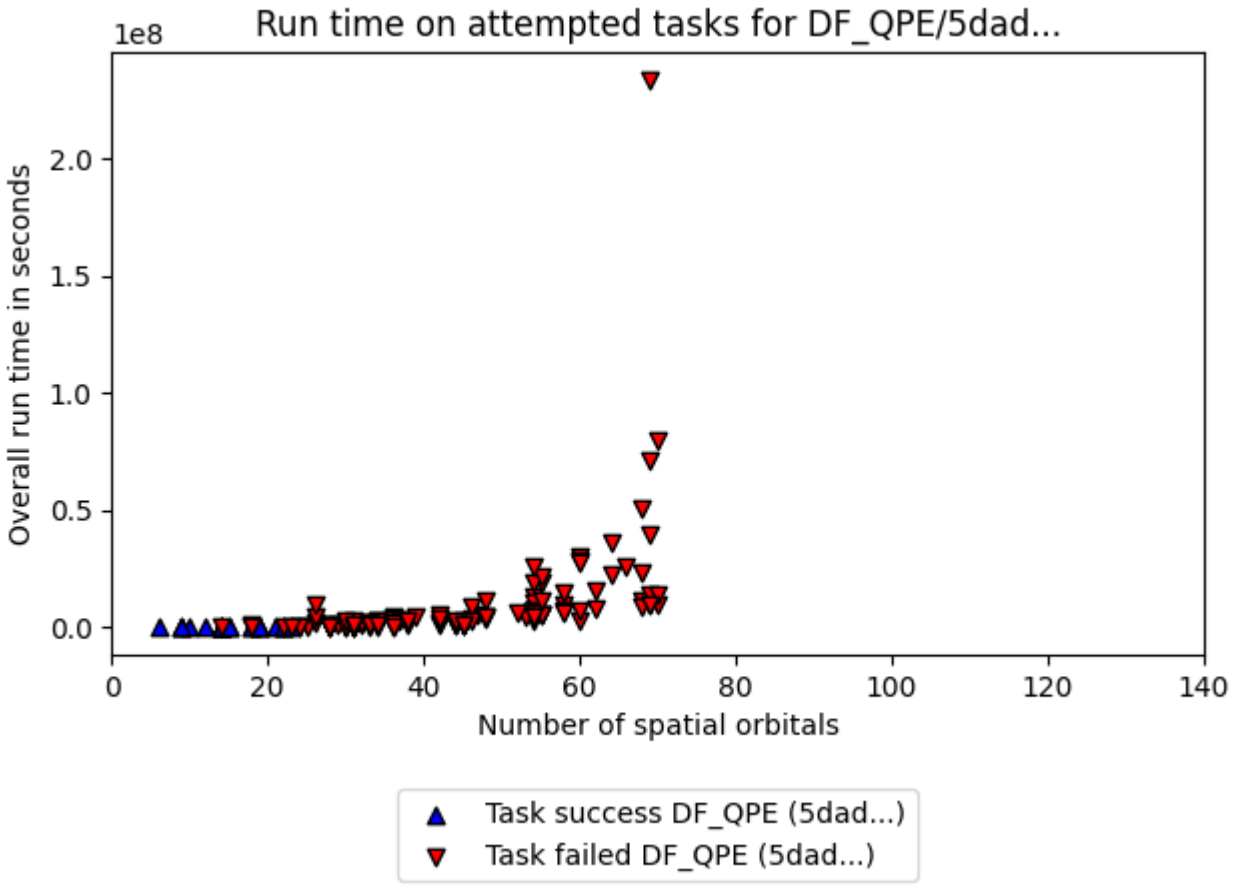
max_run_time_of_attempted_tasks: 233737829.40462503

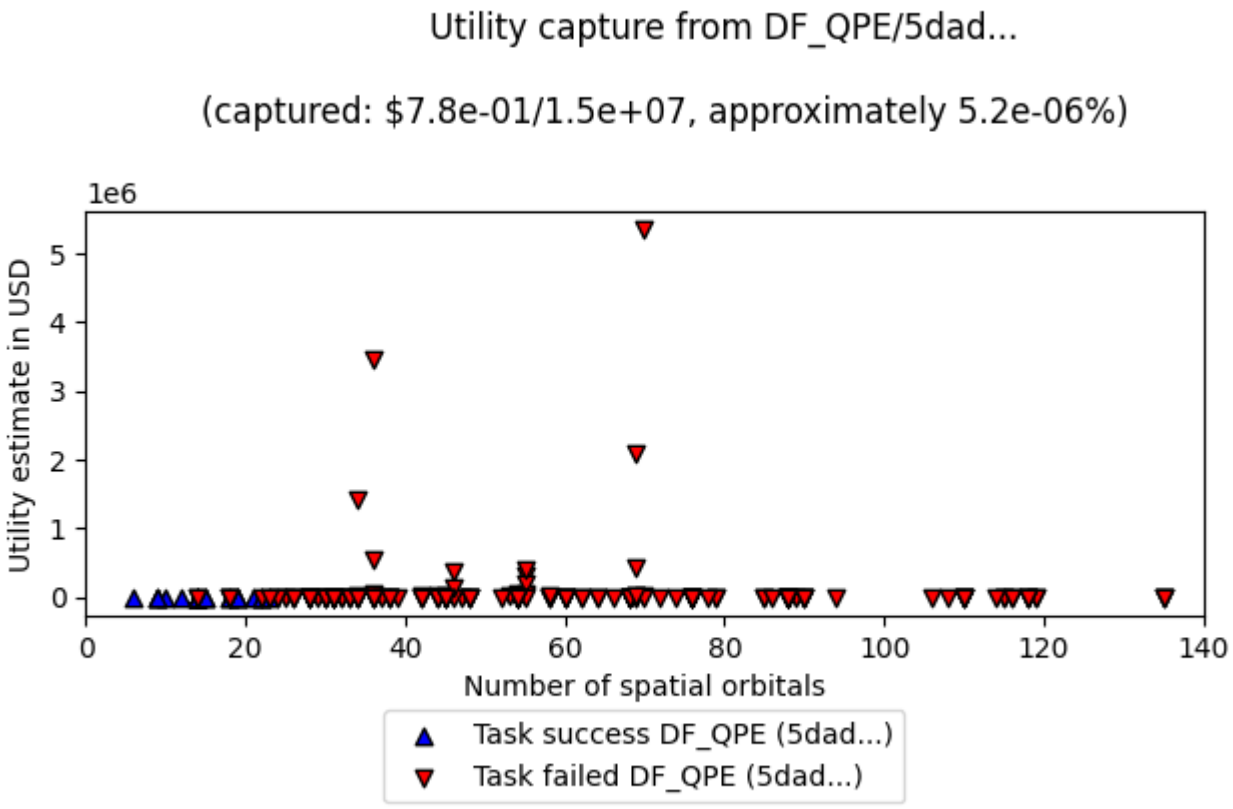
sum_of_run_time_of_attempted_tasks: 1180589418.3385448

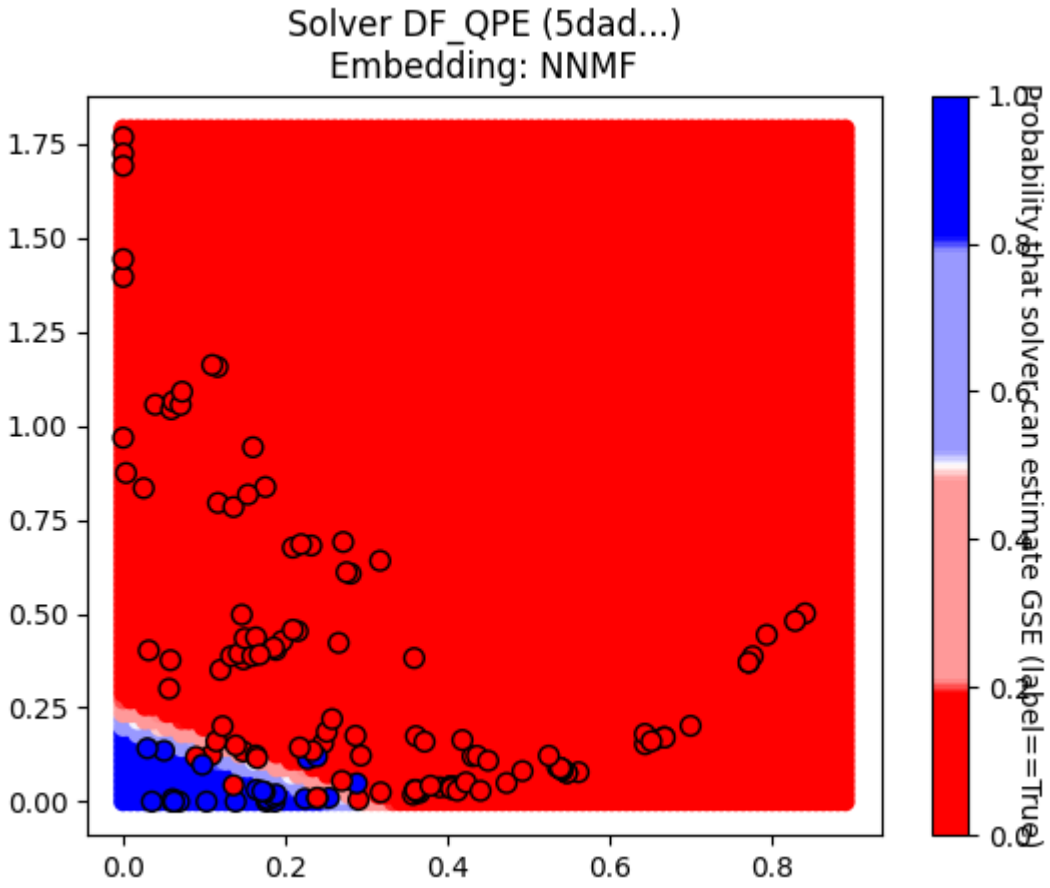
solvability_ratio: 0.0235

f1_score: [0.9819819819819819, 0.9259259259259259]

ml_metrics_calculator_version: 1


Run time on attempted tasks for DF_QPE/5dad...
1e8
Overall run time in seconds
2.0
1.5
1.0
0.5
0.0
0
20
40
60
80
100
120
140
Number of spatial orbitals
Task success DF_QPE (5dad...)
Task failed DF_QPE (5dad...)


Utility capture from DF_QPE/5dad...
(captured: $7.8e-01/1.5e+07, approximately 5.2e-06%)
1e6
Utility estimate in USD
Number of spatial orbitals
Task success DF_QPE (5dad...)
Task failed DF_QPE (5dad...)



SHAP summary plot

Solver DMRG_Niagara_cluster_lowest_energy, 16537433-9f4c-4eae-a65d-787dc3b35b59

solver_uuid:16537433-9f4c-4eae-a65d-787dc3b35b59

solver_short_name:DMRG_Niagara_cluster_lowest_energy

compute_hardware_type:classical_computer

classical_hardware_details:{'computing_environment_name': 'Niagara Cluster, Compute Canada', 'cpu_description': '40 Intel "Skylake" cores at 2.4 GHz or 40 Intel "CascadeLake" cores at 2.5 GHz', 'ram_available_gb': '202 GB (188 GiB)', 'clock_speed': '2.4 GHz or 2.5 GHz', 'total_num_cores': 40}

algorithm_details:DMRG with the lowest variational energy obtained so far.

software_details:Block2 v0.5.3rc16 with dmrghandler, commit version d603fdc6409fc194a416aa3a519362d5d91790d9 or later.

performance_metrics_uuid: 36fdbf4f-9357-4b93-9406-67dc15eba132

creation_timestamp: 2025-01-23T13:31:51.327173+00:00

number_of_problem_instances: 82

number_of_problem_instances_attempted: 82

number_of_problem_instances_solved: 8

number_of_tasks: 230

number_of_tasks_attempted: 230

number_of_tasks_solved: 72

number_of_tasks_solved_within_run_time_limit: 230

number_of_tasks_solved_within_accuracy_threshold: 72

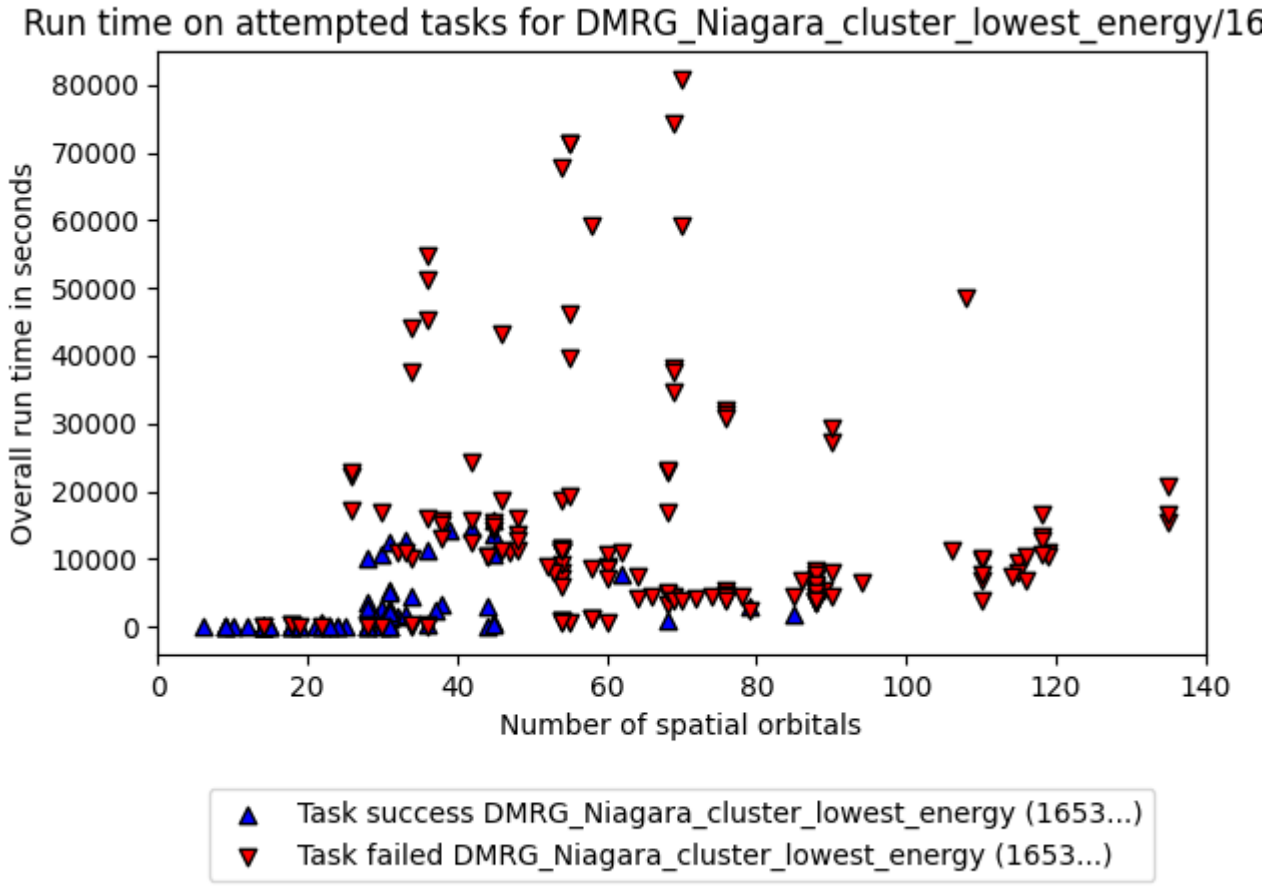
max_run_time_of_attempted_tasks: 80820.729907066

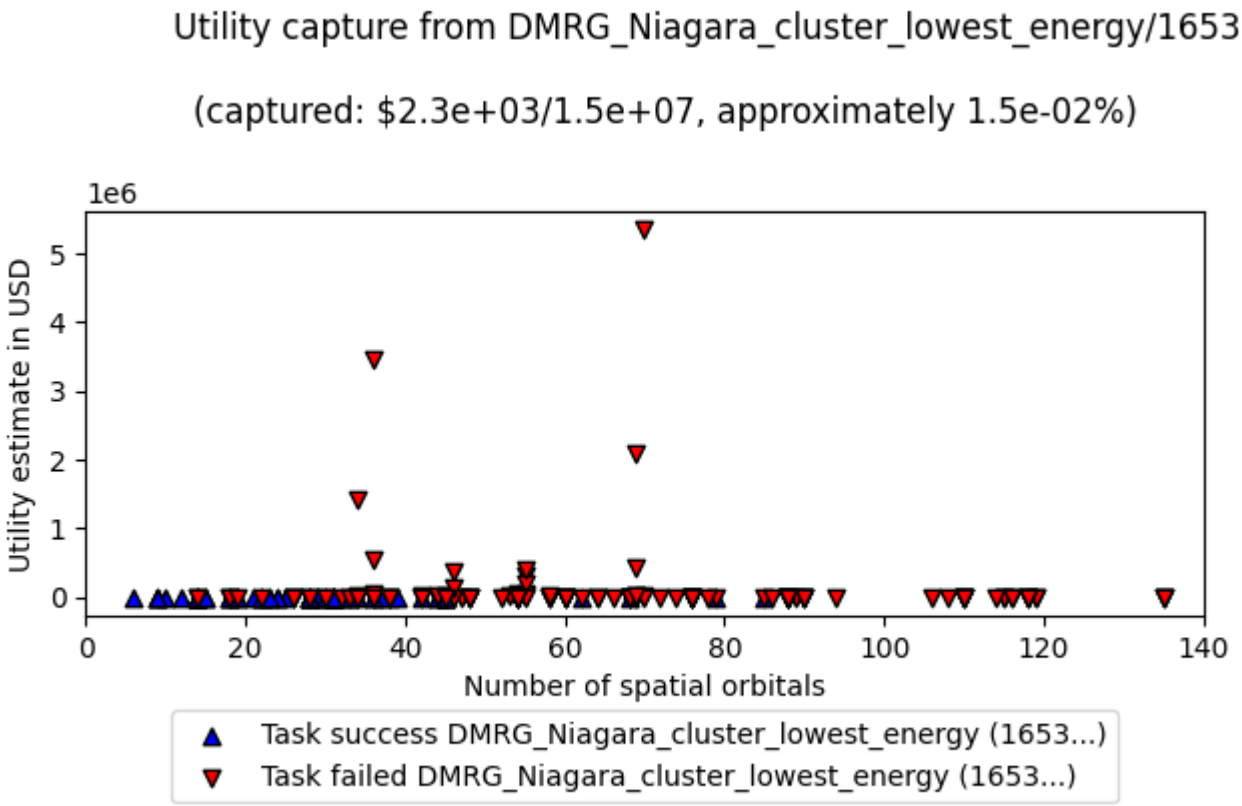
sum_of_run_time_of_attempted_tasks: 2456481.4481055504

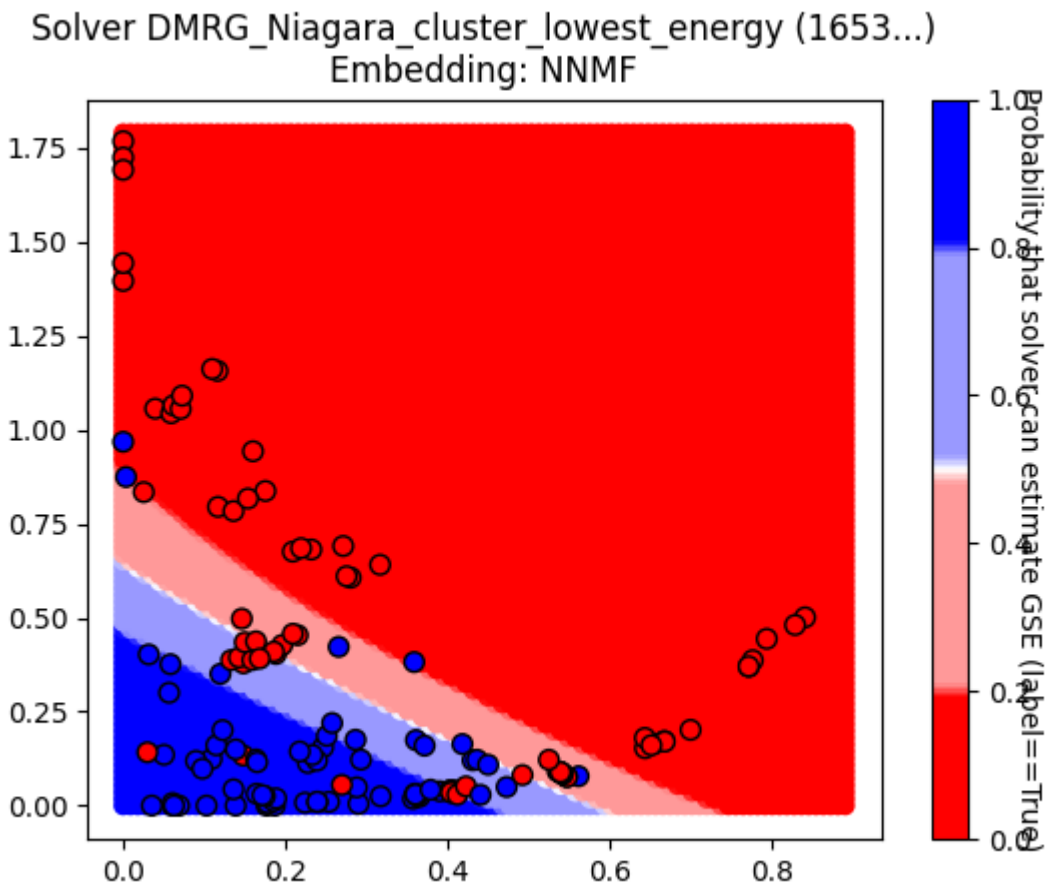
solvability_ratio: 0.1179

f1_score: [0.8955223880597015, 0.9014084507042254]

ml_metrics_calculator_version: 1




Utility capture from DMRG_Niagara_cluster_lowest_energy/1653..
(captured: $2.3e+03/1.5e+07, approximately 1.5e-02%)
1e6
Utility estimate in USD
Number of spatial orbitals
Task success DMRG_Niagara_cluster_lowest_energy (1653...)
Task failed DMRG_Niagara_cluster_lowest_energy (1653...)



SHAP summary plot