

## optimGPR

Noise level optimization that implements optimized model by embedded kernel tuning process.

### Syntax

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```
Mdl = optimGPR(TrainDS, TestDS, GPROptions, verbose)
```

### Description

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**Mdl = optimGPR(TrainDS, TestDS, GPROptions, verbose)** initiates regression model by training data and passed options. Solves min search via bayesopt for optimizing noise level. At each process step buit model is reinitiated and tuned to fit best on training data. The noise optimization can be performed by SLLA ans SLLR. Depends configuration of GPROptions. The loss computation is done on all forwarded test data.

### Examples

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```
load config.mat PathVariables GPROptions;
TrainFiles = dir(fullfile(PathVariables.trainingDataPath, 'Training*.mat'));
TestFiles = dir(fullfile(PathVariables.testDataPath, 'Test*.mat'));
assert(~isempty(TrainFiles), 'No training datasets found.');
```

```
assert(~isempty(TestFiles), 'No test datasets found.');
```

```
try
    TrainDS = load(fullfile(TrainFiles(1).folder, TrainFiles(1).name));
    TestDS = load(fullfile(TestFiles(1).folder, TestFiles(1).name));
catch ME
    rethrow(ME)
end
```

```
Mdl = optimGPR(TrainDS, TestDS, GPROptions, verbose);
[fang, frad, fcos, fsin, fcov, s, ciang, cirad] = predDS(Mdl, TestDS)
[AAED, SLLA, SLLR, SEA, SER, SEC, SES] = lossDS(Mdl, TestDS);
```

### Input Arguments

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**TrainDS** loaded training data by infront processsed sensor array simulation.

**TestDS** loaded test data by infront processsed sensor array simulation.

**GPROptions** loaded parameter group from config.mat. Struct with options.

**verbose** activates prompt for true or 1. Vice versa for false or 0.

### Output Arguments

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**Mdl** fully optimized model struct with tuned hyperparameters and optimized noise level.

### Requirements

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- Other m-files required: None
- Subfunctions: initGPR, tuneKernel, computeOptimCriteria, lossDS, optimizableVariable, bayesopt
- MAT-files required: None

### See Also

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- [bayesopt](#)
- [optimizablevariable](#)
- [initGPR](#)

- [tuneKernel](#)
- [computeOptimCriteria](#)
- [lossDS](#)

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```
function Mdl = optimGPR(TrainDS, TestDS, GPROptions, verbose)

    % init model by training data and initial options
    Mdl = initGPR(TrainDS, GPROptions);

    % create noise variance s2n used in GPR with bounds
    s2n = optimizableVariable('s2n', GPROptions.s2nBounds, 'Transform', 'log');

    % create function handle for bayes optimization
    SLL = GPROptions.SLL;
    fun = @(OptVar) computeOptimCriteria(OptVar, Mdl, TestDS, SLL, verbose);

    % perform bayes noise optimization
    results = bayesopt(fun, s2n, ...
        'Verbose', verbose, ...
        'MaxObjectiveEvaluations', GPROptions.OptimRuns, ...
        'AcquisitionFunctionName', 'expected-improvement-per-second');

    % update options with results and reinit model and tune to final model
    Mdl.s2n = results.XAtMinObjective.s2n;
    Mdl = tuneKernel(Mdl, verbose);

    % compute final loss and get mean log loss for angles and radius as
    % indicator of model total model fit
    [~, SLLA, SLLR] = lossDS(Mdl, TestDS);
    Mdl.MSLLA = mean(SLLA);
    Mdl.MSLLR = mean(SLLR);

end
```