Detector optimization quiz

Quiz, 10 questions

10 points

1.
Grid search is one of the most popular and the simplest methods of optimization. It defines a grid of the parameter values and calculates the objective function values for each node in the grid. Select correct statements:

- [ ] It is preferable to use the grid search when the objective function has a lot of parameters to optimize
- [ ] The grid search finds the optimum of the objective function using as small number of the function calculations as possible
- [x] Grid search is reasonable to use when the number of parameters is small
- [x] The grid size exponentially grows with number of parameters to optimize
- [x] The grid search requires large computational resources

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10 points

2.
Bayesian optimization is a method of finding the optimum of an expensive function. The goal of the Bayesian optimization is to find the optimum of the objective function using as small number of the function calculations as possible.

- (•) True
- ( ) False

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10 points

3.
In Gaussian processes vector of target function observations y defined as $y = f + \epsilon$. It is supposed that $f = \mathcal{N}(0, K)$, where $\mathcal{N}(0, K)$ is a normal distribution with covariance matrix K. Lets define $k(x_i, x_j)$ is an element of the matrix K in i^{th} row and j^{th} column. Select the most appropriate function for $k(x_i, x_j)$:

- ( ) $k(x_i, x_j) = \sigma^2 e^{d^2(x_i, x_j)}$, where σ is constant and d is euclidean distance.
- (•) $k(x_i, x_j) = \sigma^2 e^{-d^2(x_i, x_j)}$, where σ is constant and d is euclidean distance.
- ( ) $k(x_i, x_j) = \sigma$, where σ is constant and d is euclidean distance.
- ( ) $k(x_i, x_j) = \sigma^2 d^2(x_i, x_j)$, where σ is constant and d is euclidean distance.

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10 points

4.
In Gaussian processes vector of target function values has distribution $p(y_{N+1\times 1}) = \mathcal{N}(0, C_{N+1})$ and $p(y_{N+1}|y_{N\times 1}) = \mathcal{N}(\mu_{GP}(x_{N+1}), \sigma_{GP}(x_{N+1}))$. Select the correct statement:

- (•) $\mu_{GP}(x_{N+1}) = k^T C_N^{-1} y_{N\times 1}$
- ( ) $\mu_{GP}(x_{N+1}) = k^T C_N^{-1} y_N$
- ( ) $\mu_{GP}(x_{N+1}) = k^T C_N^{-1} k$
- ( ) $\mu_{GP}(x_{N+1}) = c - k^T C_N^{-1} k$

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5.

In Gaussian processes vector of target function values has distribution $p(y_{N+1\times 1}) = \mathcal{N}(0, C_{N+1})$ and $p(y_{N+1}|y_{N\times 1}) = \mathcal{N}(\mu_{GP}(x_{N+1}), \sigma_{GP}(x_{N+1}))$. Select the correct statement:

- $\sigma_{GP}(x_{N+1}) = k^T C_N^{-1} y_{N\times 1}$
- $\sigma_{GP}(x_{N+1}) = c - k^T C_N^{-1} k$
- $\sigma_{GP}(x_{N+1}) = k^T C_N^{-1} y_N$
- $\sigma_{GP}(x_{N+1}) = k^T C_N^{-1} k$

10 points

6.

Objective function is used during Bayesian optimization to estimate the next point of the objective function calculation.

- False
- True

10 points

7.

Lower Confidence Bound (LCB) function in Bayesian optimization is used for:

- Objective function minimization and maximization
- Objective function maximization
- Objective function minimization

10 points

8.

Lower Confidence Bound function is defined as $LCB(x) = \mu(x) - k\sigma(x)$, where k is constant. Select true statements:

- [x] Large k corresponds to exploration property of the optimization.
- [ ] Large k corresponds to exploitation property of the optimization.
- [x] Small k corresponds to exploitation property of the optimization.
- [ ] Small k corresponds to exploration property of the optimization.

10 points

9.

The key features of the exploitation:

- [x] It needs less iterations than for exploration to find the optimum
- [ ] It is more likely that the found optimum is global

- [x] It takes a new point at each iteration close to found optimum of the objective function
- [ ] All regions of the objective function are explored

10 points

10.

The key features of the exploration:

- [x] It needs more iterations than for exploitation to find the optimum
- [ ] It needs less iterations than for exploration to find the optimum
- [ ] Other regions of the objective function are not explored
- [x] All regions of the objective function are explored

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