Setting

Choices of variance (without modification to prevent overflow)

$$v_k = \frac{v}{(1-v)^\alpha}, \quad \alpha = 0, \frac{1}{3}, \frac{1}{2}, 1.$$

Additional variances are

$$\beta_k \mathrm{diag}(v_k)$$

Rationale for investigation:

- When $\alpha = 1$, β_k's shrink to 0.
- Choosing $\alpha \in (0, 1)$ slows the increase of variance with missing data.
- The variance, except when $\alpha = 0$, still achieves infinity as $v \to 1$.
- $\alpha = 0$ recovers the original v.

Observations:

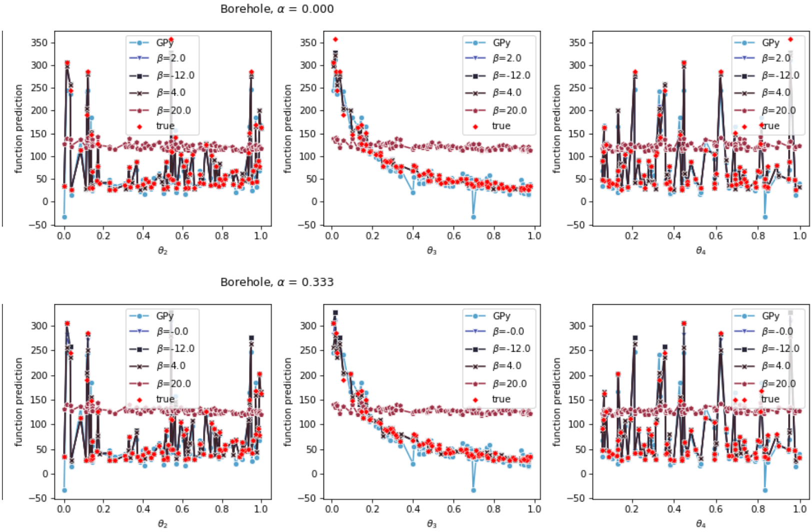
- optimal β_k decreases as α increases, as they compensate each other.

Summary of emulation comparisons (variance = v_k

- Functions: borehole, OTL circuit, Wing weight, and piston
- Number of locations: 25
- Number of training parameters: 50
- x are sampled uniformly in $[0, 1]^{d_x}$
- θ are sampled from latin hypercube sampling in $[0, 1]^{d_\theta}$
- Test parameters are sampled uniformly in $[0, 1]^{d_\theta}$
- Failures are **random**

Notice the optimized β value in the legend.

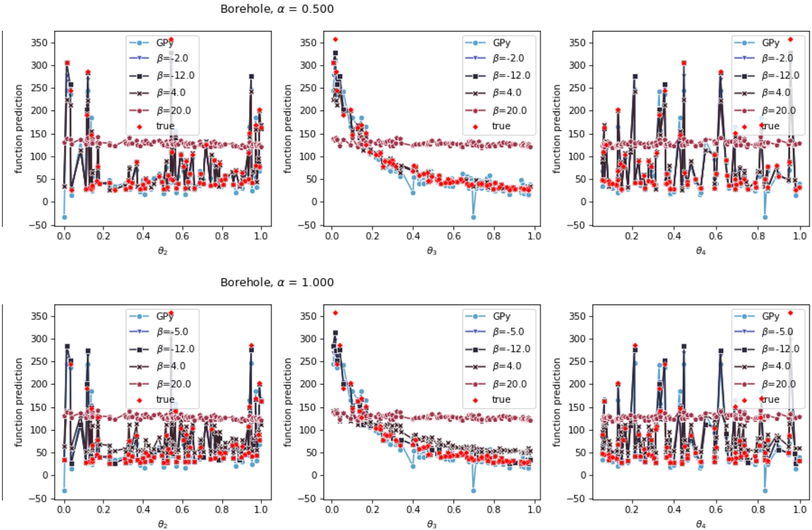
Example: borehole function



*legend (top to bottom):

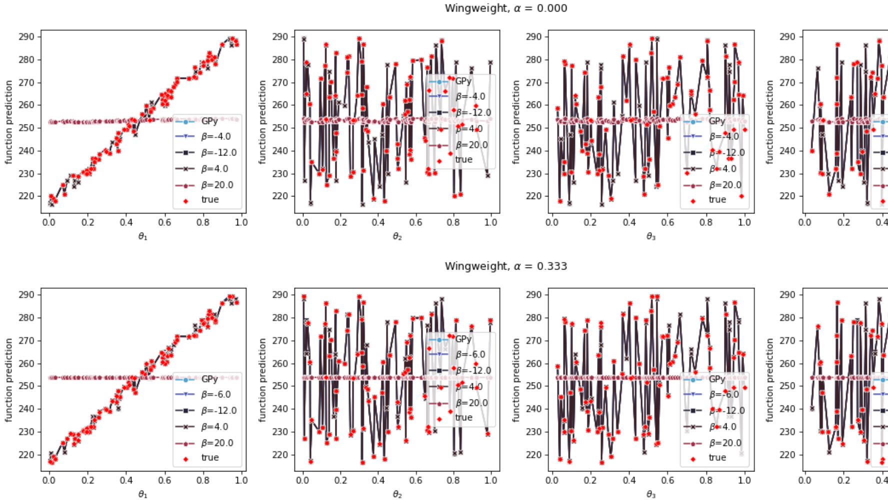
GPy, PCGPwM (optimized, $\log(\beta_k)$ = -12, 4, 20)

Example: borehole function



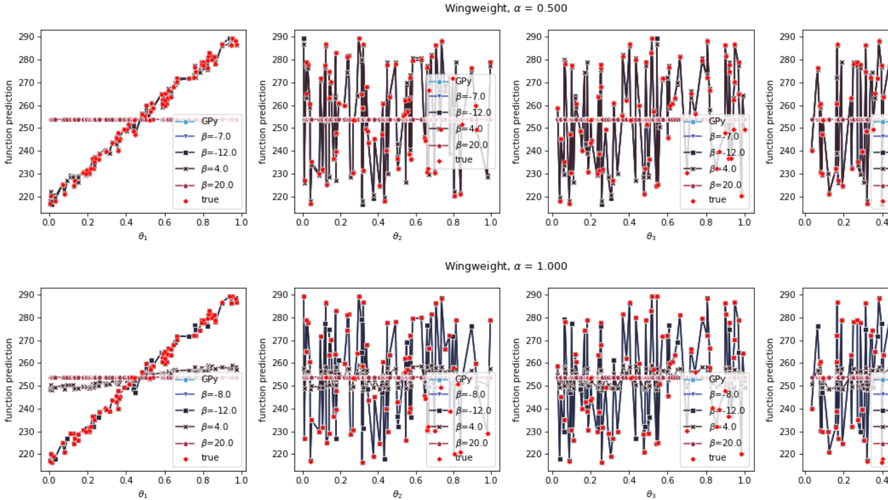
*legend (top to bottom):
GPy, PCGPwM (optimized, $\log(\beta_k)$ = -12, 4, 20)

Example: Wingweight function



*legend (top to bottom):
GPy, PCGPwM (optimized, $\log(\beta_k)$ = -12, 4, 20)

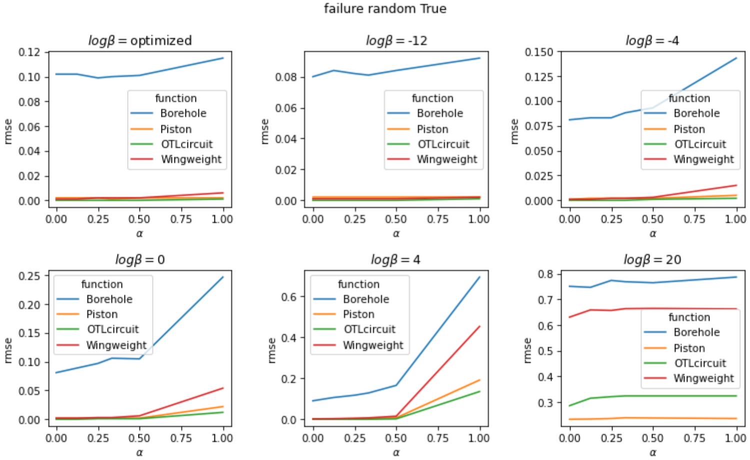
Example: Wingweight function



*legend (top to bottom):
GPy, PCGPwM (optimized, $\log(\beta_k)$ = -12, 4, 20)

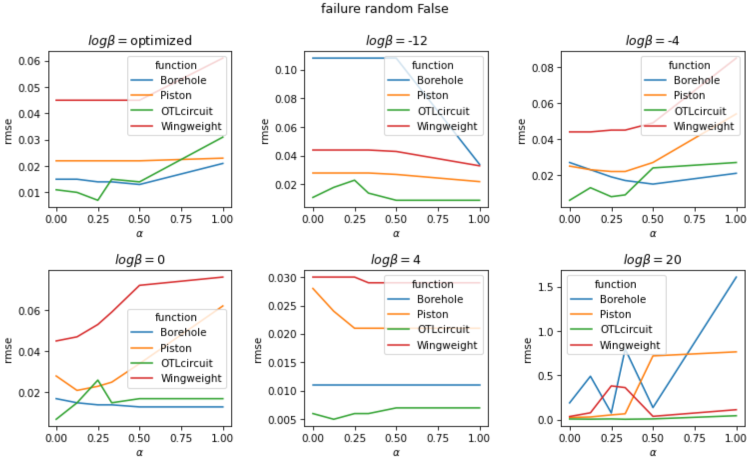
RMSE and α

Random failures



RMSE and α

Structured failures



Conclusion

Select α between 1/8 and 1/2.