# Pipeline

February 24, 2019

## 1 Kernel methods for biological sequence classification

MVA 2019 - Kernel methods for machine learning

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```
In [1]: %load_ext autoreload
        %autoreload 2

In [2]: import numpy as np

In [3]: import backend
        from kernels import LinearKernel, GaussianKernel, GramCSVKernel, FeatureCSVKernel, Mul

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```

Kernel computed on the fly on imported data

```
In [4]: kernels1a = LinearKernel().load("mat100", indices=[0, 1, 2])
        kernels1b = GaussianKernel(0.1).load("mat100", indices=[0, 1, 2])
```

Linear kernel computed on the fly on imported features

```
In [5]: kernels2a = FeatureCSVKernel("SpectralKernel6", {}).load("spectr6", indices=[0, 1, 2])
        kernels2b = FeatureCSVKernel("SpectralKernel3", {}).load("spectr3", indices=[0, 1, 2])
        kernels2c = FeatureCSVKernel("TranslatedKernel", {}).load("trans6", indices=[0, 1, 2])
```

Precomputed kernel defined from stored Gram matrices

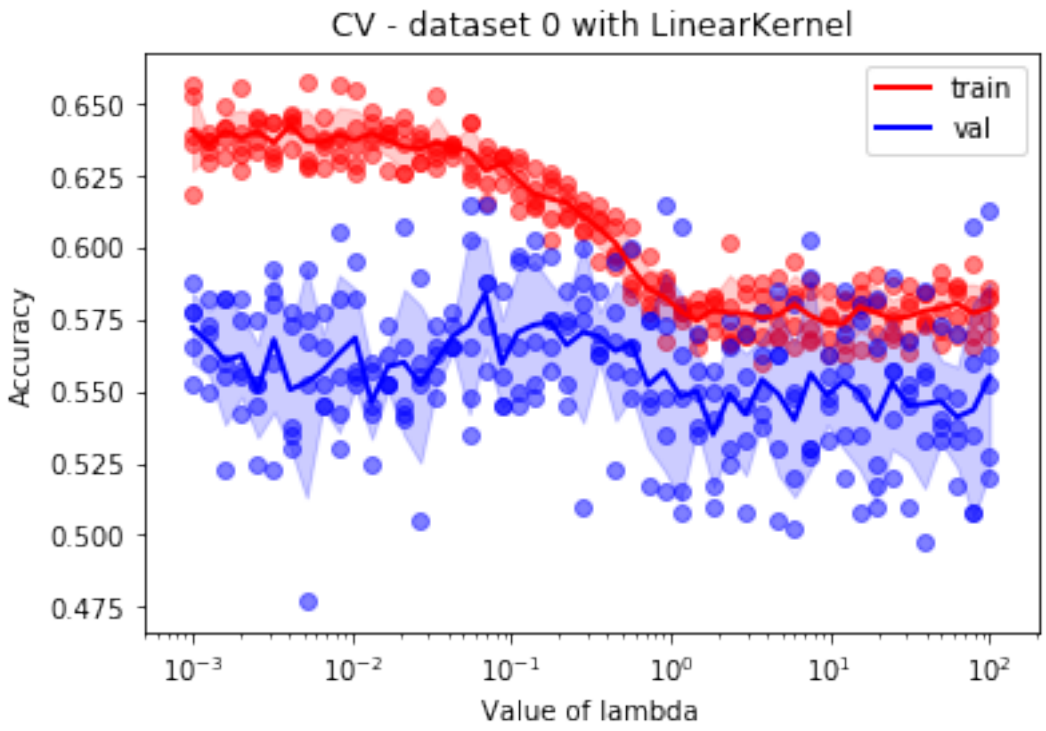
```
In [6]: kernels3 = GramCSVKernel("SubstringKernel", {}).load("substring4_0.7", indices=[0])
```

Parameter tuning

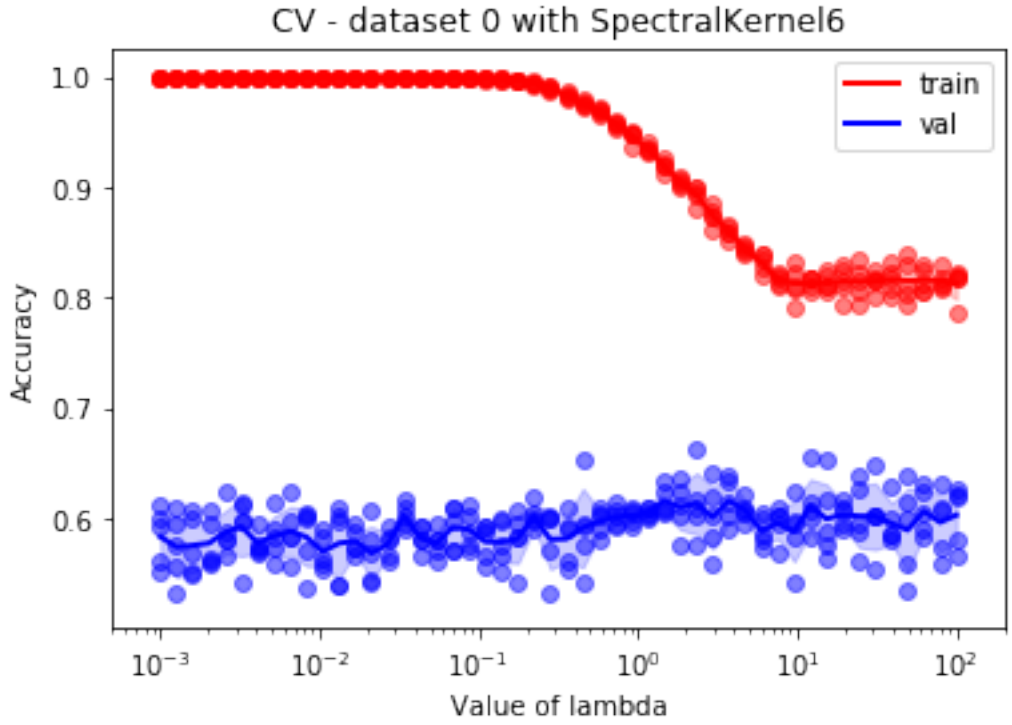
```
In [7]: lambdas = np.logspace(-3, 2, 50)
```

In [8]:
```
three_kernels = []
three_lambdas = []

use_multiple_kernel = False

for d in [0, 1, 2]:

    kernels_to_combine_or_compare = [
        kernels1a[d],
        # kernels1b[d],
        kernels2a[d],
        kernels2b[d],
        kernels2c[d]
    ]
    if d == 0:
        kernels_to_combine_or_compare.append(kernels3[0])

    if use_multiple_kernel:

        best_kernel = MultipleKernel(
            kernels_to_combine_or_compare,
            grad_step=5e-1, iterations=10)
        best_lambd = backend.tune_parameters(
            [best_kernel], lambdas,
            plot=True, result="best_lambdas")[0]

    else:
        best_kernel, best_lambd = backend.tune_parameters(
            kernels_to_combine_or_compare, lambdas,
            plot=True, result="best_kernel_lambda")

    three_kernels.append(best_kernel)
    three_lambdas.append(best_lambd)
```

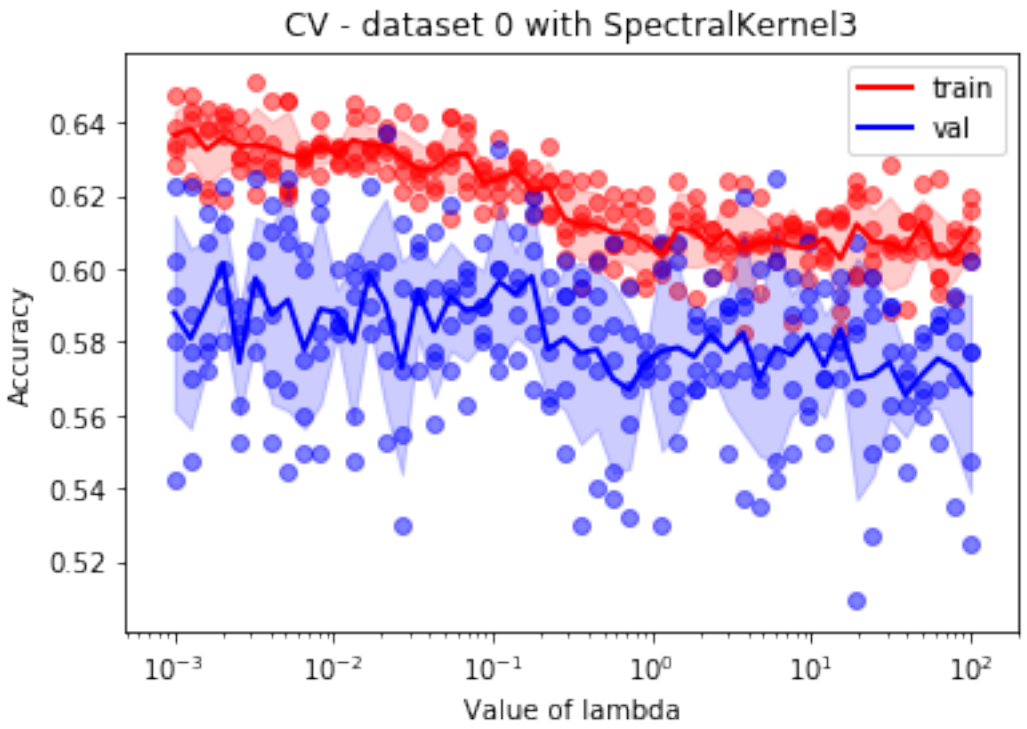
```
Tuning lambda on dataset 0 with kernel LinearKernel and params {'suffix': 'mat100'}: 100%|| 50/
```



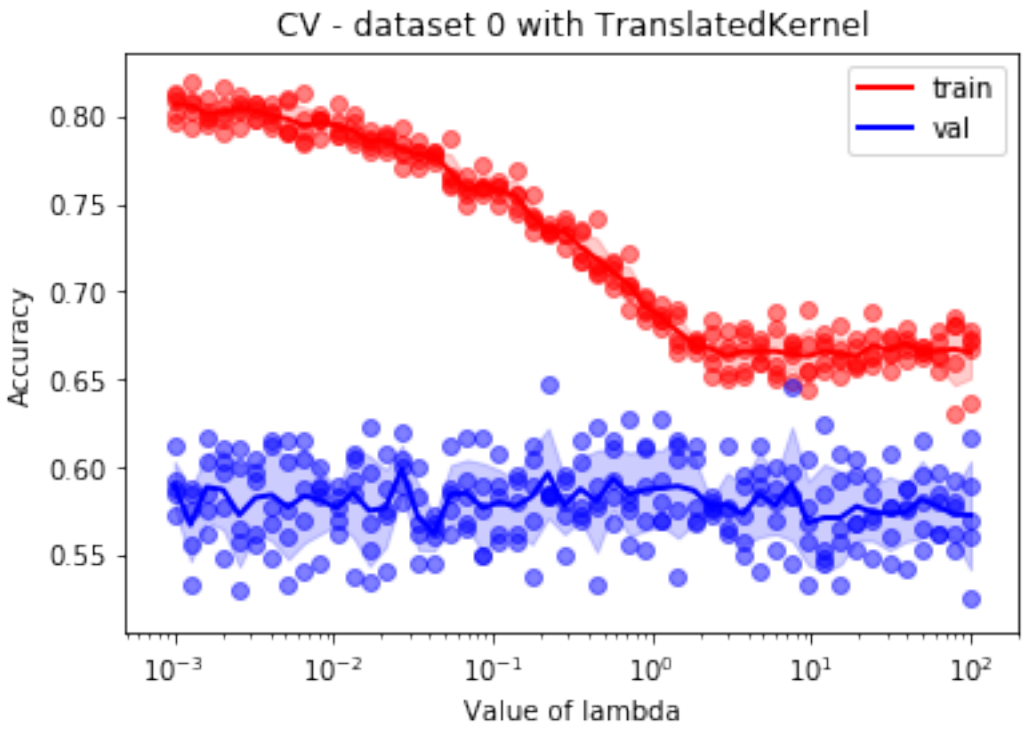

```
Tuning lambda on dataset 0 with kernel SpectralKernel6 and params {'suffix': 'spectr6'}: 100%|
```



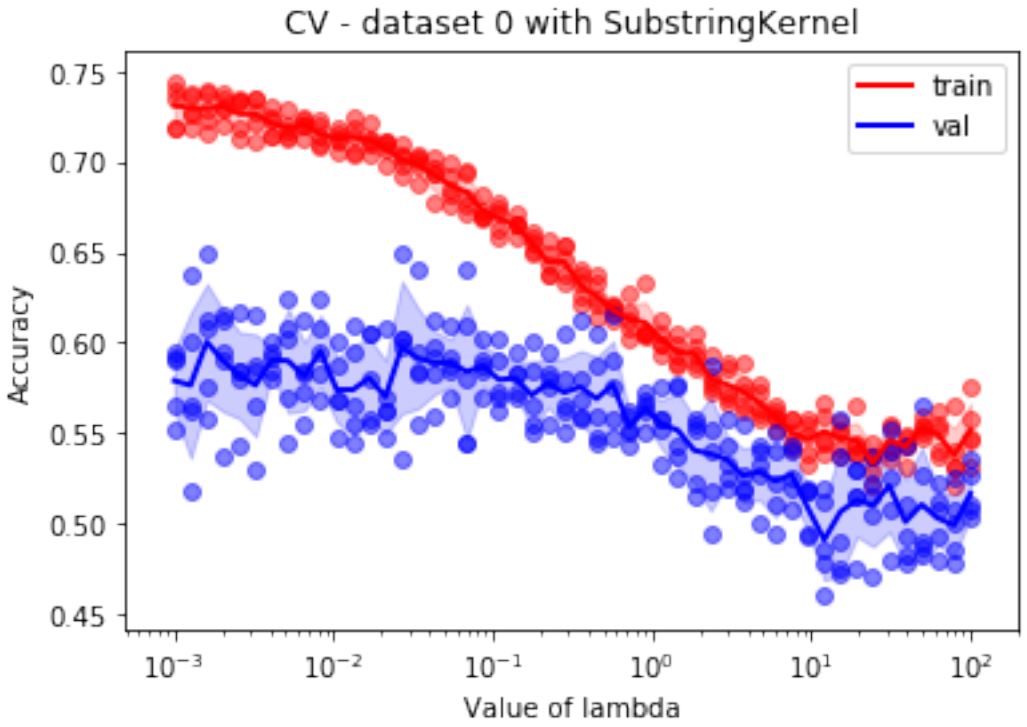
```
Tuning lambda on dataset 0 with kernel SpectralKernel3 and params {'suffix': 'spectr3'}: 100%|
```



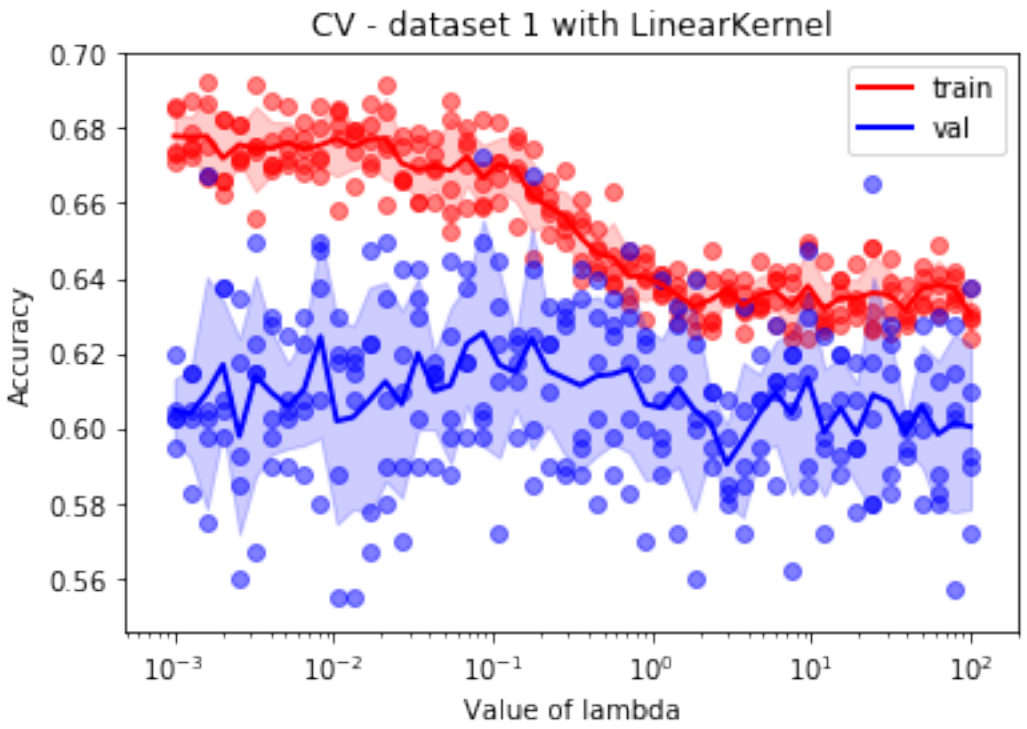

```
Tuning lambda on dataset 0 with kernel TranslatedKernel and params {'suffix': 'trans6'}: 100%|
```



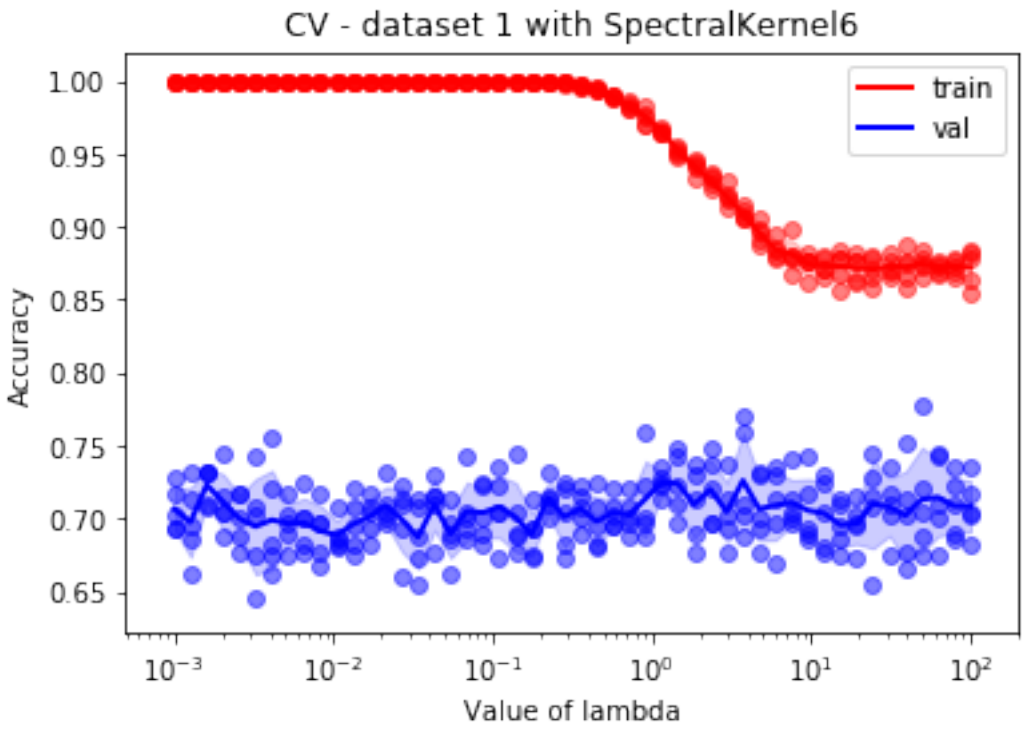

```
Tuning lambda on dataset 0 with kernel SubstringKernel and params {'suffix': 'substring4_0.7'}
```



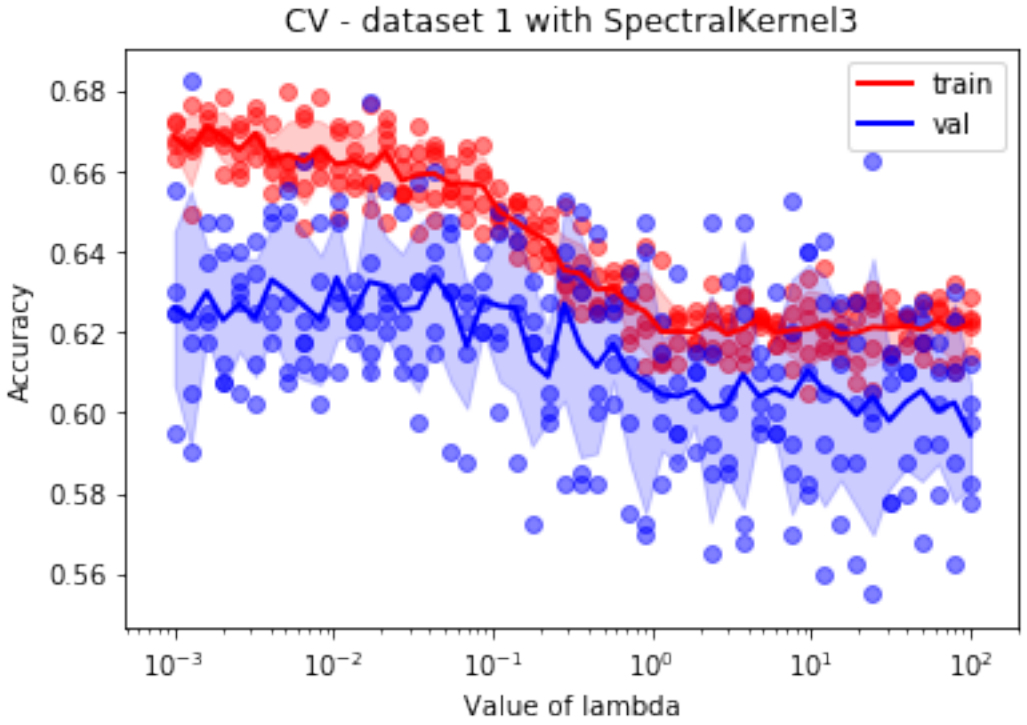
```
Tuning lambda on dataset 1 with kernel LinearKernel and params {'suffix': 'mat100'}: 100%|| 50/
```



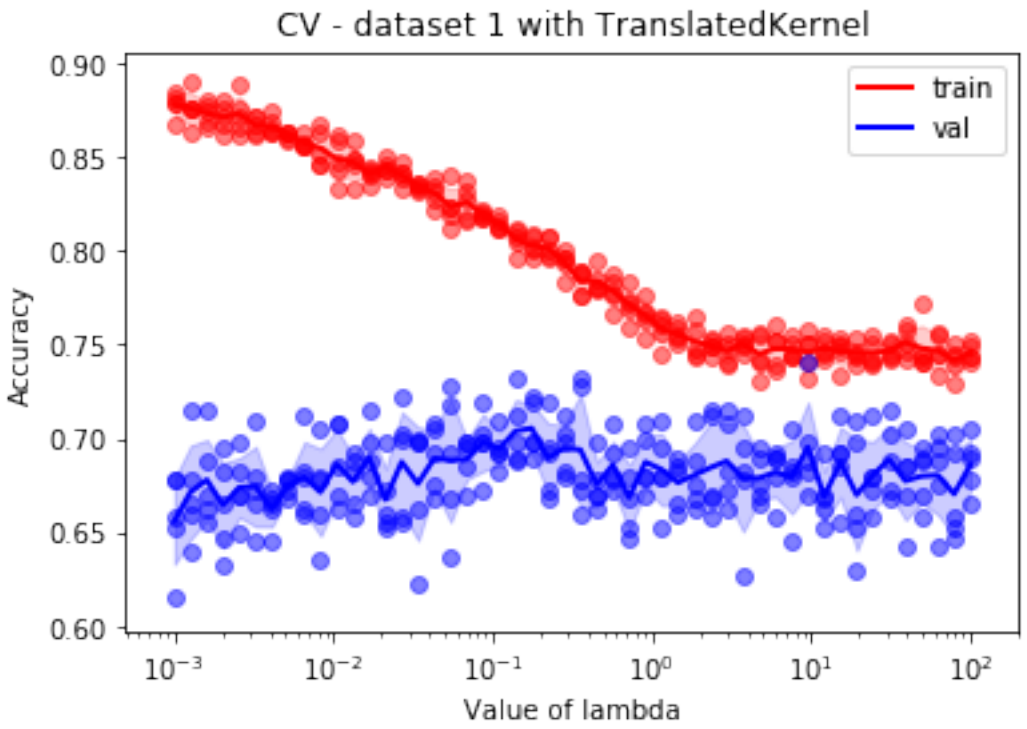

```
Tuning lambda on dataset 1 with kernel SpectralKernel6 and params {'suffix': 'spectr6'}: 100%|
```



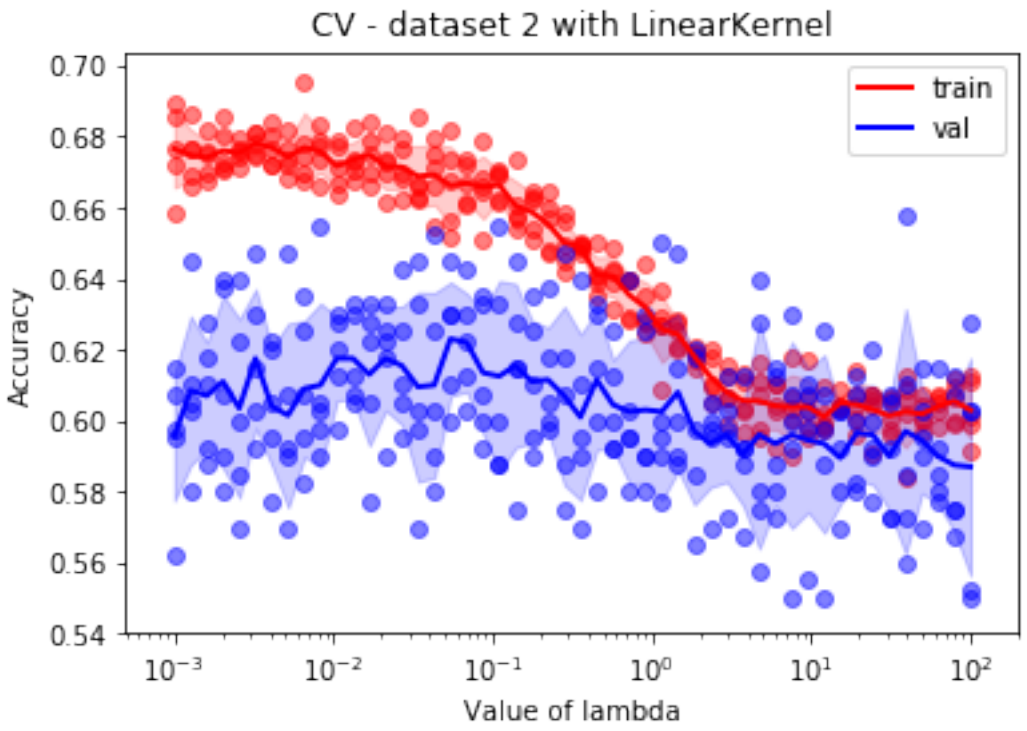

```
Tuning lambda on dataset 1 with kernel SpectralKernel3 and params {'suffix': 'spectr3'}: 100%|
```



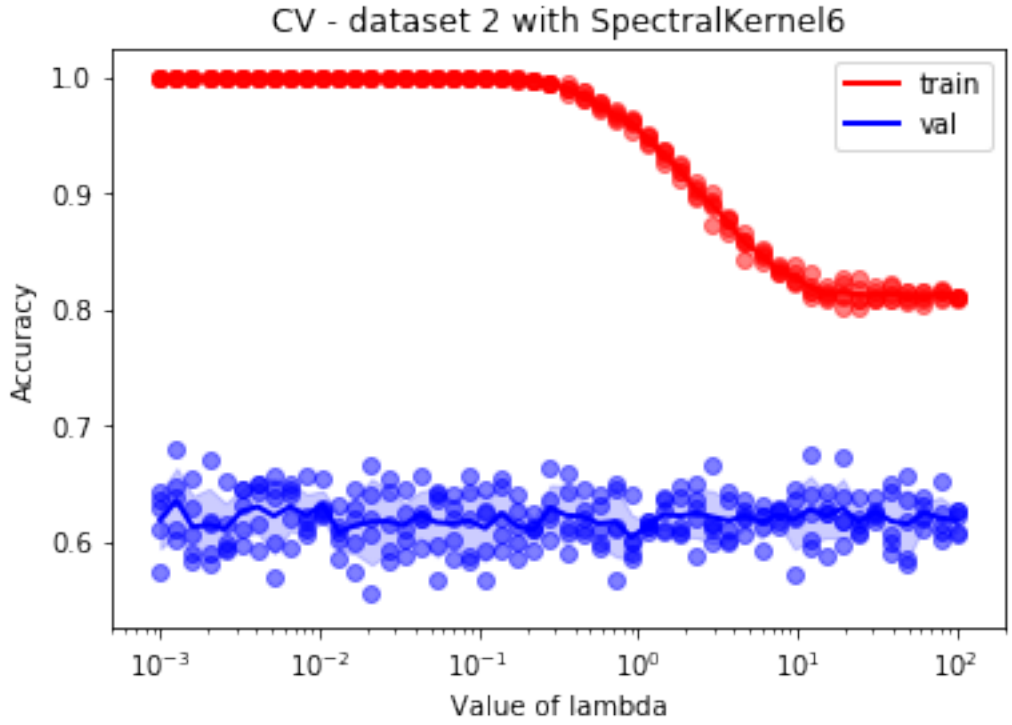
```
Tuning lambda on dataset 1 with kernel TranslatedKernel and params {'suffix': 'trans6'}: 100%|
```



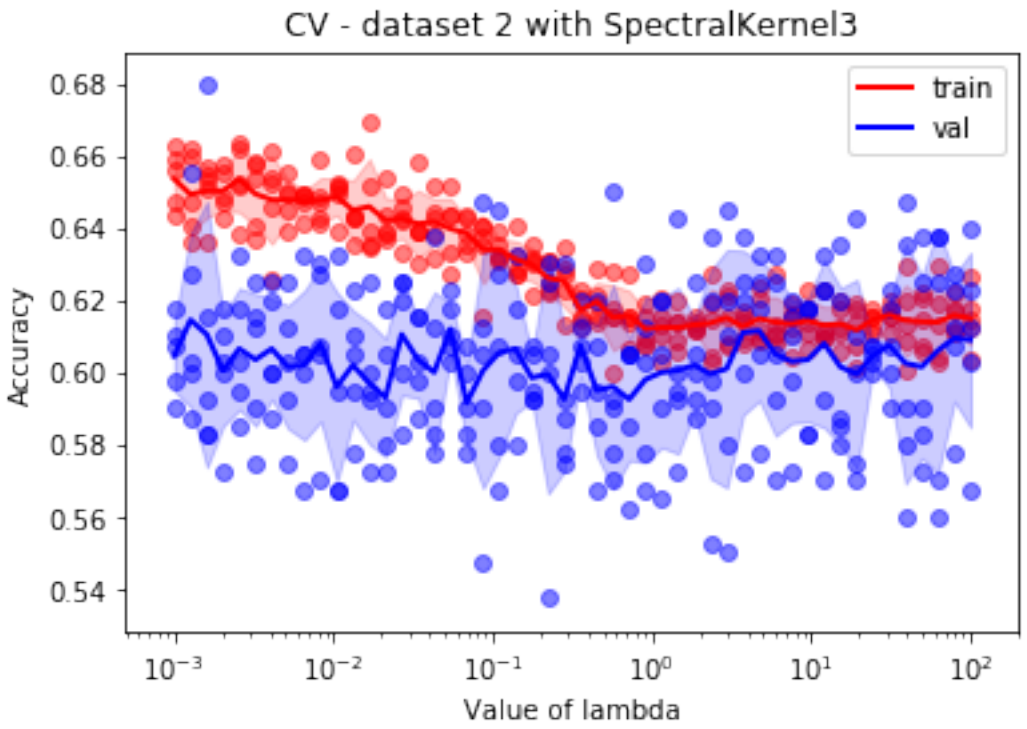

```
Tuning lambda on dataset 2 with kernel LinearKernel and params {'suffix': 'mat100'}: 100%|| 50/
```



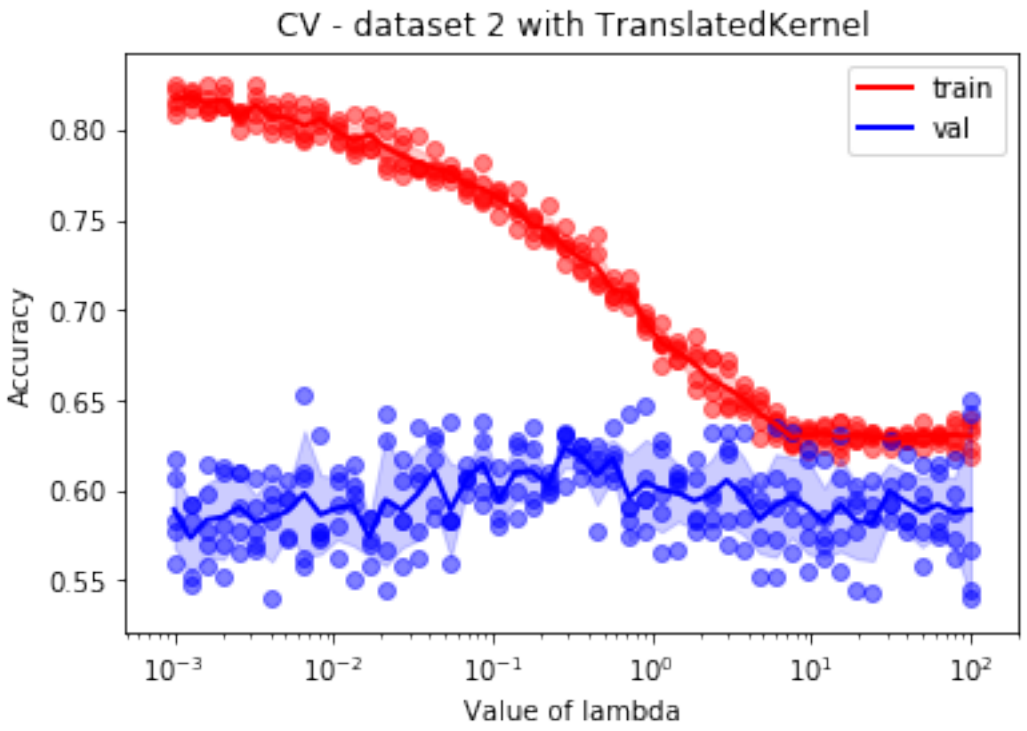

```
Tuning lambda on dataset 2 with kernel SpectralKernel6 and params {'suffix': 'spectr6'}: 100%|
```



```
Tuning lambda on dataset 2 with kernel SpectralKernel3 and params {'suffix': 'spectr3'}: 100%|
```




```
Tuning lambda on dataset 2 with kernel TranslatedKernel and params {'suffix': 'trans6'}: 100%|
```




In [9]: backend.final_prediction(three_kernels, three_lambdas)

```
DATASET 0
DATASET 1
DATASET 2
```