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Part 1. Coding

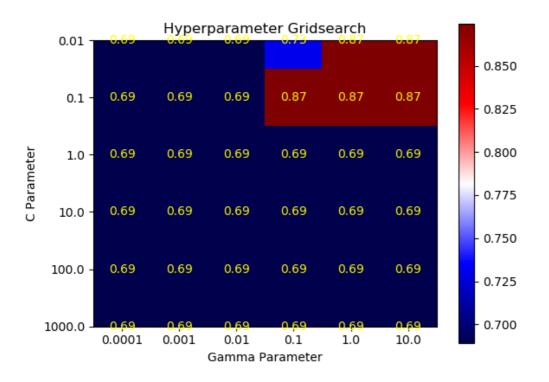
1.

```
Split: 1, Training index: [ 1
                                             8 10 11 12 13 14 15 16 17 18], Val
idation index: [ 0 7 9 19]
Split: 2, Training index: [ 0
                                    6
                                             9 10 11 12 13 14 16 17 18 19], Val
idation index: [ 2 4 5 15]
Split: 3, Training index: [ 0
                                                   9 11 13 14 15 16 17 19], Val
                              1 2
                                       5
idation index: [ 3 10 12 18]
                                                   9 10 11 12 14 15 18 19], Val
Split: 4, Training index: [ 0
idation index: [ 8 13 16 17]
Split: 5, Training index: [ 0
                              2
                                 3
                                       5
                                             8 9 10 12 13 15 16 17 18 19], Val
idation index: [ 1 6 11 14]
```

2.

```
{'Gamma': 0.001, 'C': 10.0}
```

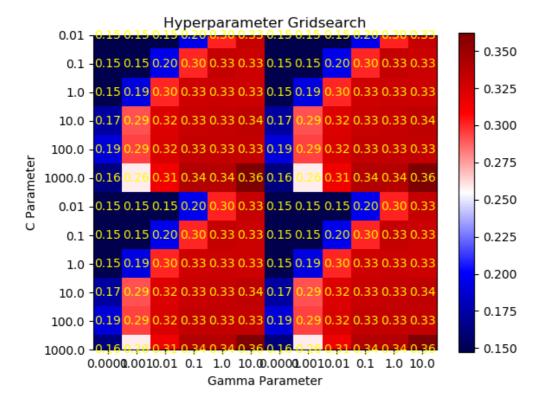
3.



4.

Accuracy score: 0.89583333333333334

5.



Part2.

```
1. k, (x, x') is valid.

(i) We know k, (x, x') is valid and k, (x, x') = \langle \phi_1(x), \phi_1(x') \rangle

if k(x, x') = c k, (x, x'), c > 0

then C k, (x, x') = C \phi_1(x)^T \phi_1(x')

= \int_C \phi_1(x^T) \int_C \phi_1(x')

let \int_C \phi_1(x) = \phi(x) and \int_C \phi_1(x^T) = \phi(x)^T

\Rightarrow C k_1(x, x') = \phi(x)^T \phi(x')

ii) We know k_1(x, x') is valid and k_1(x, x') = \langle \phi_1(x), \phi_1(x) \rangle

if k(x, x') = f(x) k_1(x, x') f(x'), f(x) is constant

then f(x) k_1(x, x') f(x') = f(x) \phi_1(x)^T \phi_1(x') f(x')

-let \phi(x) = f(x) \phi_1(x), \phi(x)^T = f(x) \phi_1(x)^T

= \phi(x)^T \phi_1(x')
= \langle \phi(x), \phi(x') \rangle \Rightarrow \text{proved valid}
```