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**[Problem 1]**

**(*1.1*)**

From we can conclude the following with *y* and of :

∇ (, …, ) = =

And ] is a Boolean function such that if then it is equal to 1, otherwise it is equal to 0.

Based on ∇, we know that:

∇ (, …, ) =

Which further indicates that, for each *y*, ∈ [*C*] and *n* ∈ [*N*], if > 0, then eventually we will update . Please note that we omit the constraint , because when , then we have = 0, which still satisfies the condition. Therefore, we can conclude that:

for each *n* ∈ [*N*] and *c* ∈ [*C*],

**(*1.2*)**

Text

Description automatically generated with medium confidence

Pick a point (, ) randomly.

For each *c* in 1…*C*:

If :

**(*1.3*)**

Text

Description automatically generated with medium confidence

Pick a point (, ) randomly.

For each *c* in 1…*C*:

If :

Details on how the was found:

Since , so

=

=

**[Problem 2]**

**(*2.1*)**

ℓ = =

**(*2.2*)**

ℓ =

**(*2.3*)**

A picture containing text

Description automatically generated

Let denote what is in , then:



with learning rate η (default is 1 if undefined):

**[Problem 3]**

Since and are both kernel functions, thus there exist and such that:

Let be entries in , and are entries in .

And let be entries in , also are entries in .

Then, we observe that:

*k* (***x***, ***x’***) = (***x***, ***x’***) (***x***, ***x’***)

=

=

=

=

= , for some .

Therefore, based on the definition, we had proven that *k* (***x***, ***x’***) is also a kernel function.