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Machine Learning Final Exam Paper

SVM Hand Calculation

\*Code dapat diakses pada folder “code files” didalam folder yang sama dengan file ini.

Chart, scatter chart

Description automatically generatedGambar disamping merupakan hasil dari plotting data setelah dilakukan kalkulasi SVM, data saya plotting untuk memvisualisasikan support vectors, yang akan berguna untuk keperluan hand calculation SVM.

Berdasarkan array support vectors diatas, saya define 3 buah variable SV sebagai berikut :

1. SV1 = (-0.49786339, 1.84886877), y1 = -1
2. SV2 = (-0.45701287, 1.53946451), y2 = -1
3. SV3 = (-1.82041156, -0.10675079), y3 = 1
4. SV4 = (-1.87170722, 2.32769161), y4 = 1

Kernel Table :

|  |  |  |  |
| --- | --- | --- | --- |
| K (SV1, SV1) | K (SV1, SV2) | K (SV1, SV3) | K (SV1, SV4) |
| K (SV2, SV1) | K (SV2, SV2) | K (SV2, SV3) | K (SV2, SV4) |
| K (SV3, SV1) | K (SV3, SV2) | K (SV3, SV3) | K (SV3, SV4) |
| K (SV4, SV1) | K (SV4, SV2) | K (SV4, SV3) | K (SV4, SV4) |
| αA | αB | αC | αD |

K (SV1, SV1) = (-0.49786339 \* -0.49786339) + (1.84886877 \* 1.84886877) = 3.66618368 αA

K (SV1, SV2) = (-0.49786339 \* -0.45701287) + (1.84886877 \* 1.53946451) = 3.07379783 αB

K (SV1, SV3) = (-0.49786339 \* -1.82041156) + (1.84886877 \* -0.10675079) = 0.70894806 αC

K (SV1, SV4) = (-0.49786339 \* -1.87170722) + (1.84886877 \* 2.32769161) = 5.23545082 αD

K (SV2, SV1) = (-0.45701287 \* -0.49786339) + (1.53946451 \* 1.84886877) = 3.07379783 αA

K (SV2, SV2) = (-0.45701287 \* -0.45701287) + (1.53946451 \* 1.53946451) = 2.57881174 αB

K (SV2, SV3) = (-0.45701287 \* -1.82041156) + (1.53946451 \* -0.10675079) = 0.66761245 αC

K (SV2, SV4) = (-0.45701287 \* -1.87170722) + (1.53946451 \* 2.32769161) = 4.43879291 αD

K (SV3, SV1) = (-1.82041156 \* -0.49786339) + (-0.10675079 \* 1.84886877) = 0.70894806 αA

K (SV3, SV2) = (-1.82041156 \* -0.45701287) + (-0.10675079 \* 1.53946451) = 0.66761245 αB

K (SV3, SV3) = (-1.82041156 \* -1.82041156) + (-0.10675079 \* -0.10675079) = 3.32529397 αC

K (SV3, SV4) = (-1.82041156 \* -1.87170722) + (-0.10675079 \* 2.32769161) = 3.15879454 αD

K (SV4, SV1) = (-1.87170722 \* -0.49786339) + (2.32769161 \* 1.84886877) = 5.23545082 αA

K (SV4, SV2) = (-1.87170722 \* -0.45701287) + (2.32769161 \* 1.53946451) = 4.43879291 αB

K (SV4, SV3) = (-1.87170722 \* -1.82041156) + (2.32769161 \* -0.10675079) = 3.15879454 αC

K (SV4, SV4) = (-1.87170722 \* -1.87170722) + (2.32769161 \* 2.32769161) = 8.92143614 αD

Linear Equations :

-3.66618368 αA - 3.07379783 αB + 0.70894806 αC + 5.23545082 αD + b = -1

-3.07379783 αA - 2.57881174 αB + 0.66761245 αC + 4.43879291 αD + b = -1

-0.70894806 αA - 0.66761245 αB + 3.32529397 αC + 3.15879454 αD + b = 1

-5.23545082 αA - 4.43879291 αB + 3.15879454 αC + 8.92143614 αD + b = 1

-αA - αB + αC + αD + b = 0

Untuk mempersingkat waktu, saya menggunakan gaussian online calculator.

Link : <https://onlinemschool.com/math/assistance/equation/gaus/>

**αA** = 5.34285484

**αB** = -6.34329536

**αC** = 0.60936415

**αD =** 0.06319895

**b** = -1.67300973

Dari kalkulasi diatas, didapatkan bahwa bias memiliki nilai = -1.67300973

Weight Calculation :

W = αA(SV1) + αB(SV2) + αC(SV3) + αD(SV4)

= 5.34285484 [-0.49786339, 1.84886877] + -6.34329536 [-0.45701287, 1.53946451] + 0.60936415 [-1.82041156, -0.10675079] + 0.06319895 [-1.87170722, 2.32769161]

= [-2.66, 9.87823745] + [2.89896761, -9.76527808] + [-1.10929354, -0.06505010] + [-0.11828993, 0.14710766]

= [-0.98861586, 0.19501693]

Evaluasi Hand Calculation :

Hasil yang saya dapatkan untuk Weight dan Bias dari model SVM ini adalah sebagai berikut :

Weight = [-0.98861586 0.19501693]

Bias = -1.67300973

Dan dibawah adalah hasil SVC library calculation yang saya gunakan pada python code :

Weight = [-1.43035116 -0.02982673]

Bias = -1.60751825

Text

Description automatically generated