# **Week 5 –** **Predictive Data Analysis**

# **Exercise 01: Weighted Moving Average**

A firm has the following order history over the last 6 months.

January 120

February 95

March 100

April 75

May 100

June 50

* What would be a 3-month moving average forecast for July?

|  |  |  |
| --- | --- | --- |
| **Month** | **Actual** | **3-month**  **Moving Average** |
| January | 120 |  |
| February | 95 |  |
| March | 100 |  |
| April | 75 | (120+95+100)/3=105 |
| May | 100 |  |
| June | 50 |  |
| July |  | (75+100+50)/3=75 |

>> Predict value for July: 75

* What would be a 3-month weighted moving average forecast for July, using weights of 40% for the most recent month, 30% for the month preceding the most recent month, and 30% for the month preceding that one?

>> Predict value for July: 75\*0.3 + 100\*0.3 + 50\*0.4= 72.5

# **Exercise 02: Exponential smoothing**

The mean price for rubber during 10 years is shown in the Table below:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Price | 82 | 80 | 76 | 73 | 72 | 73 | 72 | 73 | 77 | 74 |

* Give a forecast for the price of schnaps in 2010 based on simple exponential smoothing.

>> Pick α=0.2

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Price | 82 | 80 | 76 | 73 | 72 | 73 | 72 | 73 | 77 | 74 |
| Forecast | 82 (assumed) |  |  |  |  |  |  |  |  |  |

>> F1=82

F2=0.2\*82 + 0.8\*82=82

And so on

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
| Price | 82 | 80 | 76 | 73 | 72 | 73 | 72 | 73 | 77 | 74 |
| Forecast | 82 (assumed) | 82 | 81.6 | 80.48 | 78.98 | 77.587 | 76.67 | 75.7358 | 75.1886 | 75.55 |

F3=0.2\*80 + 0.8\*82=81.6

F3=0.2\*76 + 0.8\*81.6=80.48

F4=0.2\*73+ 0.8\*80.48=78.984

...

>> Forecast value in 2010: ~75.55

* Compute the Mean Absolute Deviation (MAD).

>> MAD = 3.58

* Do you have any viewpoint about the choice of model in this case?

>> With short-term fluctuations (just 10 ‘items’), it’s sensitive to forecast continuous values, not fit closely with actual values.

# **Exercise 03: Items-based Recommender**

Three computers, C1, C2, and C3, have the numerical features listed below:

|  |  |  |  |
| --- | --- | --- | --- |
| **Feature** | **Processor Speed** | **Disk Size** | **Memory Size** |
| C1 | 3.06 | 500 | 6 |
| C2 | 2.68 | 320 | 4 |
| C3 | 2.92 | 640 | 6 |

We may imagine these values as defining a vector for each computer; for instance, C1’s vector is [3.06, 500, 6]. We can compute the cosine distance between any two of the vectors, but if we do not scale the components, then the disk size will dominate and make differences in the other components essentially invisible. Let us use 1 as the scale factor for processor speed, α for the disk size, and β for the main memory size. In terms of α and β, compute the cosines of the angles between the vectors for each pair of the three computers in two following senerios:

* What are the angles between the vectors if α = β = 1?

>> cos(C1,C2)==0.99999733

>> cos(C2,C3)=0.99999534

>> cos(C1,C3)=0.999998785

>> Therefore angle for each pair is 0.

* What are the angles between the vectors if α = 0.01 and β = 0.5?

>> cos(C1,C2)=0.99 >> Angle: 8.1

>> cos(C2,C3)=0.97 >> Angle: 14

>> cos(C1,C3)=0.99 >> Angle: 8.1

>> Therefore angle for each pair is 0 too, as simililar as above question.

* Do you have any viewpoint about the choice of α, β in this case?

>> The choices of α, β will affect strongly on cos of angles between the vectors.