SOM 306

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Now I will go through the moving average problem.

The concept of moving average is this.  I ask you what is your forecast for the next period.  You may be very conservative or very aggressive.

If you are conservative, if I have 999 pieces of data, the average of those is 10.   Now we are in this period, I ask your forecast for the next period?  If you are conservative you say you want to add all 1000 numbers, average them and that's your forecast.

This is a good procedure if you don't have much fluctuation.  It's good if we don't have much fluctuations and looking at long term trade.

But suppose demand in the period comes out at 1010.  Still your forecast for the next period is a little more than 100 there were huge changes in demand.

When you go for long period moving averages you see long period changes but you are not quick at responding.

If you use one moving point average, your forecast for

Now if you use naive technique your forecast for next period is 1010.  You immediately show reaction to what happened.  If you want to rely a little bit less on the last period you may think of 2 period moving average.  For example if moving average in this period is 1010, last period is 10, you add them, divide by 2 and say "my forecast for next period is 510.

If the number gets smaller you react quickly.  If the number of periods is longer, your reaction to what is happening in the market will be more smooth.  What is the answer to ... this question [On overhead.]

Responsiveness of forecast means when something happens in market we show reaction to that.  It should be?  Decreased!  Excellent.

What is the answer to question 2?  [On overhead.]   We take the last 3 numbers, add them up, divide by 3, that is 3 period moving average.  What is the answer?

It says for example "find A - F."  The difference between those is forecast error.

Then you remove the negative signs, that is absolute forecast error.  Then you look at your notes and then ... you find MAD is summation of these numbers divided by the number of observations.

So 4+8+3=15

15÷4=3.75

You will see the tracking signal is a summation, look at this [On overhead.]   4−3=1+8=9

Summation of forecasting error is 9.  Now we have everything.  Summation of forecasting error is there, MAD is there, we divide them by each other.  We get 2.4.  Any objection?

Forecast errors are these numbers.  Forecast error means A - F.  But MAD doesn't have negative numbers.  Look at everything as positive numbers.

If forecast is greater than actual or vice versa doesn't matter.  Both state we were not precise.  We can never be precise, there were 3 systematic components and one random.  In reality we may have trends, a systematic component.

For example we may realize that every year CSUN population increases by 2%.  That is something we can capture.  There is seasonality.  In winter demand for ski equipment is high.  Low in summer.  The reverse is true for swimming.  That we can capture and incorporate into our forecasting.

In reality we have cycles, every 5 to 10 years we have recession and boom.  In boom they are much better than recession.  Those are systematic components.  We can find those systematic components and include it into the forecasting.

But there's one extra component.  Random component.  We really don't know how many students show up today, no matter how complicated a technique I use to see how many are in today's class I never know.  That's because there is random.

I may say 100 people show up, but it won't repeat.  It's impossible to come out with an exact forecast which exactly tell us demand.

That's why when we forecast we are not comfortable with just one number.  We are not comfortable with that.  Usually we say what?

Professor: When I want to forecast I say "my forecast for next year has .... a mean of 100 and a standard devotion of 10.  Therefore my forest for the demand of the next period is not deterministic, it is Probabilistic"

We know if something has normal distribution 99.73% of observations are between mean plus and minus 3 standard deviations.

67% of observations are between mean plus and minus standard deviation.  When someone asks our forecast, we are not happy with one number.  Thing would be average but also we give standard devotion.

If we ask how many students show up in normal class I say 100 with standard devotion of 10.  That means almost 100% probability students are between 70 and 130.

I use math for two purposes.  One, math measures deviation of forecast.  Absolute difference of forecast.  We find the difference of actual and forecast, drop the negative sign.  I don't care of actual is greater than forecast or otherwise.

I could have had other opportunities.  When you did regression in SOM120 or MATH140, when you do regression in order to find the regression line you try to minimize what?

Professor: When you develop the regression line in statistics you try to minimize some of the squares of the difference between actual and forecast.

This is positive, this is negative, this is 0. What do you expect tracking signal to me? 500? 10000? 11? What do you expect an average to see as the value of the tracking signal? 0. You expect to see 0.

Tracking signal has MAD in the denominator. MAD is a positive number, right?

In the numerator, tracking signal has summation of A−F. If you have an unbiased forecasting technique you expect sometimes actual is greater than forecast and on other times forecasting greater than actual.

If you have a correct forecasting technique you have already absorbed and included all 3 systematic components of demand. The only component of reality which is not included into your forecasting technique is the random component of reality. You expect that sometimes to be greater than you expect, sometimes less.

On average positive and negative numbers should cancel out. On average, tracking signal should be 0. Make sense? Obviously it isn't 0. What we expect tracking signal to be is something like this [On overhead.]

Some random observation, sometimes above 0, sometimes below, but being around 0.

Then we define an upper control limit and lower control limit. In later slides I show what they mean. But for the purpose of this discussion. Positive 10 and -10are fine. In many books they say 4and -4 but I have mathematically proved it isn't correct.

Male Student: If it is random, how can it be seasonal?

Professor: It is not seasonality. If you observe seasonality here something is wrong with our forecasting. But I don't see seasonality. Any questions? okay.

If you see seasonality here, let me fix it for you. [On overhead.]

For tracking signal, it is written in many books to be between 4and -4. I have shown it is wrong, but we will not be strict on that. If you are not comfortable with that make it 10and -10.

We want to see our observations within upper control limit UCL, and lower control limit. LCL

So in many control systems you can have an upper control limit and lower control limit to see if things are within what you expect. Same with tracking signal. But with tracking signal we don't want to see something. That is we don't want to see systematic component. By systematic component I mean we don't want to see a recognizable pattern. If we see that it means there's something in reality I have not included or I have wrongly included.

Because tracking signal has positive number in denominator.

A - F is positive, this means it is getting more positive. Right? That is summation of all A - F. So A - F is positive. That means A is greater than F. A>Fmeans we are underestimating demand. No matter what we say demand is greater than what we say. Therefore there's a problem in my forecasting technique.

Does it make sense? Any questions? question? I don't want to see a pattern like this. Any questions? I don't want to see a pattern like this [On overhead.] This is also representing the same thing. But here it says A - F is negative. So that means forecast in most observations is greater than actual and we are over estimating the demand. So we should bring our forecast down.

In tracking signal, I also don't want a pattern like our friend mentioned. We don't want to see seasonality. I don't want to see something like this [On overhead.] Because this pattern clearly states that in some periods demand is greater than actual and systematically in some other periods demand is less than actual.

That means either there's a seasonality in the actual data which I have not incorporated in my forecasting technique or I have included a seasonal component which does not exist in reality.

So regarding MAD, I use it to select among different forecasting techniques. It is useful for standard devotion, tracking signal. I want to see tracking signal within upper control limit and lower control limit and I don't want to see a pattern. Right?

Having said that, which is correct? A is correct [On overhead.]

Any questions?

[Teacher reading: Question 11]

Any objections to this? Month 6 will go from 6 to 6 ... so I have 6 down to 6 - 5 which is 1, +1, which is 2.

The most recent number has an index of T if I am talking about n period moving average. The oldest data has an index of T-n+1

I add those 5 numbers together, divide it by 5 and that would be my moving average. Now let's see 6 period moving average. [On overhead.]

It starts with 7, which is new here. It wasn't in the previous one. [ reading from the overhead ]

Therefore when I look at these 2 formula, I see these two components [On overhead.] Is repeated into both formulas. Do we agree?

But I know the repeated component that appears in both formulas, if I divide by 5 it equals 150. I can multiply that by 5, so this component equals 750. Does it make sense? Any questions?

Male Student: Why multiply by 5?

Professor: What do you mean "why"?

Male Student: So the answer, that's the answer?

Professor: No.

Male Student: Oh okay.

Professor: The answer is what - what is 6 period moving average in month 7? We know 6 period moving average in month 7 is computed this way. Now I have the green component here, red component here. I put it in the formula, that is the answer [On overhead.] Which is 155. Right?

We multiply by 5 because ...

Male Student: ... I know now.

Professor: What is a different way to compute this 155? What is another way? Don't forget, here I am trying to teach you operations management. At the same time I'd like to exercise the left side of your brain.

Male Student: 180-150÷6

Professor: That is correct. He said suppose it is not 180, suppose demand for month 7 was 150 instead of 180, right? Now I have 5 period moving average, what would be 6 period moving average?

Replace 180 by 150 and see what would happen.

This is 150 [On overhead.] Summation of these numbers divided by 5 is 150 So that means forecast in most observations is greater than actual and we are over estimating the demand. So we should bring our forecast down.

In tracking signal, I also don't want a pattern like our friend mentioned. We don't want to see seasonality. I don't want to see something like this [On overhead.] Because this pattern clearly states that in some periods demand is greater than actual and systematically in some other periods demand is less than actual.

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Male Student: 180 -150 ÷ 6

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Replace 180 by 150 and see what would happen.

This is 150 [On overhead.] Summation of these numbers divided by 5 is 150. This new piece of information is also 150. So let's assume all of them were 150. Maybe if one was 100, another was 200 ... the average is 150 and I can assume all are 150, right?

So all my data are 150, the new one is 150. So I have 6 numbers that are 150, if I add and divide by 6 the answer is 150, right?

All that has happened is it isn't 150, it is 30 units more than 150. Right? Correct? If it was 150, my 6 period moving average was 150. Now it is 180, 30 units more than 150, I divide these by 6 periods. 30 divide 6 = 5.

This is a different way to solve it. Is this what you were going to say? No?

Any questions? 5 period moving average ... you have taken 3 courses. Your GPA is 3, right? It doesn't matter if you have got 2.7 in one and 3.3 in another and 3 in one. We assume you have 3 in all. Your GPA in 3 courses is 3.

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Now you have not got B, you have got A. Which is one point greater than 3. You have had 4 courses, each is 3 units. 4×3=12

You have four courses. So you have 4 courses. In 3 of them the GPA is 3, if the 4th one GPA is 3 your GPA is 3

But it was 4. So you divide by 4 courses. If you have 3 courses with GPA 3. If in the 4th course you get A, your GPA will be lifted to 3.25. This is the concept.

There are different ways to compute something. The more you exercise the left of your brain the more solutions you will have.

Now solve this problem in 2 minutes. [On overhead.]

[Students working]

Professor: You should solve this in 2 minutes, not more.

[Students working]

Professor: So again, this is the 4 period moving average. [ reading from the overhead ]

This part of my equation = 440.

Now I go for 5 period moving average, it's this number. I have the red one and green one. I divide by 5, that's the solution.

Alternatively I could say I have 110, suppose the next is 110 - but I have 50 units extra. Talking about 5 periods. I divide by 5. Both of them are the same. Okay? Any questions?

Any questions?

In order to write the quiz you need to be able to follow this problem too.

You have 3 minutes to solve this problem [On overhead.]

[Students working]

Professor: I will quickly go through it. This is 5 period moving average in period 21.

Look at these numbers. We know the red numbers are repeated into both equations. In order to not repeat them let's call them "month"

[ reading from the overhead ]

Right? Any objection? I just called the red component "month." Any objection?

[ reading from the overhead ] Any objection?

[ reading from the overhead ] Any objection?

Objections?

What we learned, if you want to go from this period to the next one, add the newest data, drop the lowest data divided by the number of periods.

[End of class.]