**Marketing Analytics**
Professor Swagato Chatterjee
Vinod Gupta School of Management,
Indian Institute of Technology, Kharagpur
Lecture 60
Text Mining and Sentiment Analytics (Contd.)

Hello everybody. Welcome to Marketing Analytics course, this is Doctor Swagato Chatterjee from VGSOM, IIT Kharagpur who is taking this course. We are in week 11 and this is the last video in week 11. This is regarding another paper which talks about drivers of helpfulness of online hotel reviews for sentiment and emotion mining approach.

(Refer Slide Time: 00:40)
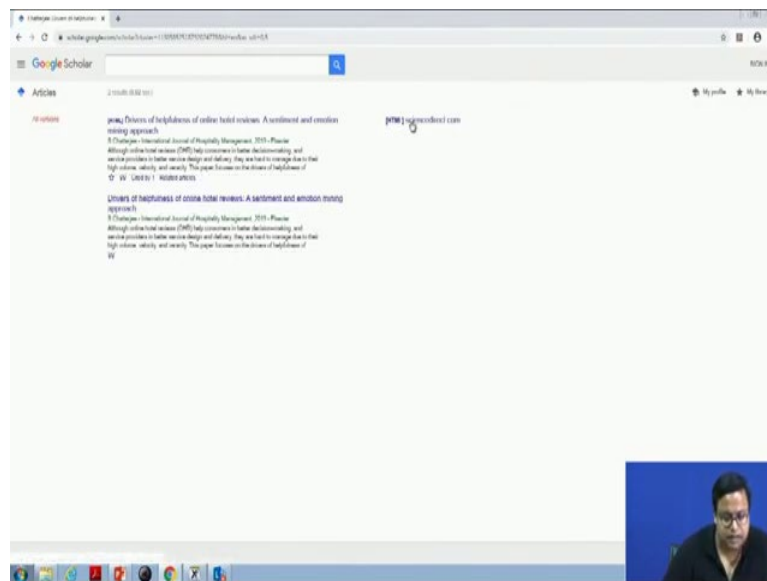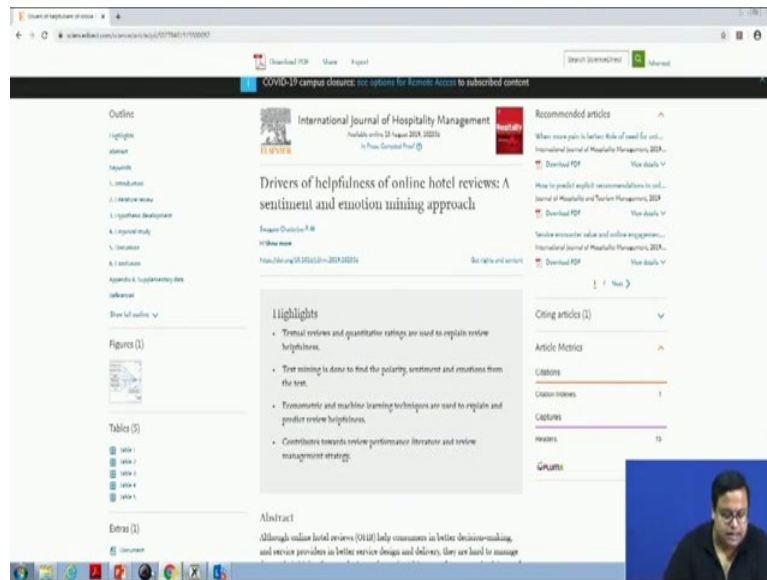
So this is something that I also want to just copy here as I did for the last video and probably paste it here. And you can again see this thing so all 2 versions you can see it in my in the ScienceDirect and you can also see in the same thing in the probably the research gate as I have shown. So drivers of helpfulness of online hotel review. So the highlights are basically this, textual reviews and quantitative ratings are used to explain review helpfulness. What is the helpfulness? We will talk about.

Text mining is done to find the polarity sentiment and emotions from the text this is far something that we will find out. Econometrics and Machine Learning techniques were used and contributes towards review performance literature and review management strategy. So let us talk about what is review, what are the helpfulness. So I will just delete this one okay.
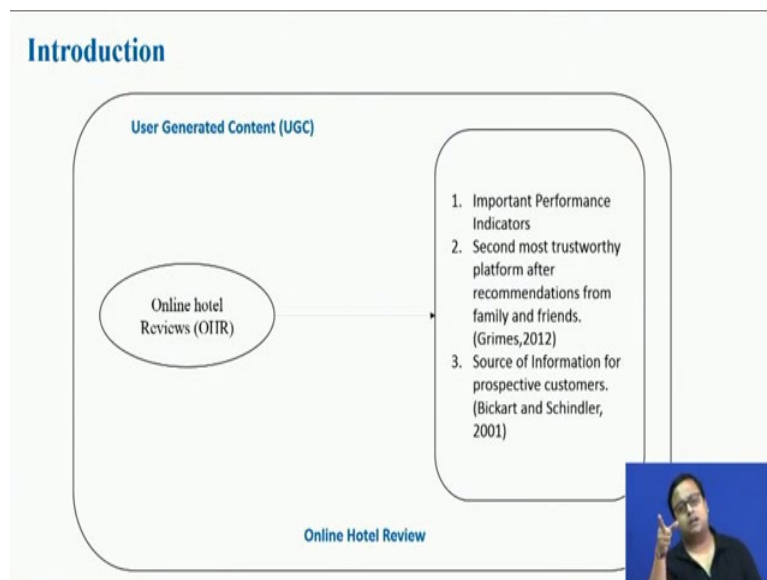
So online hotel reviews are basically again if there is an important performance indicators. They are second most trustworthy platform after recommendations from family and friends. So the most important in a hotel choice is what your family and friends are suggesting, but after that after taking into the account to the family and friends recommendation the next thing that you generally go for is the online review platforms.

And these are also source of information for prospective customers. So online hotel reviews are basically important it is very easy to understand that they are important source of information. So if they are important source of information and if I am a hotel person I have to also know that which reviews will be more contributing towards customers decision-making and which reviews will be less contributing towards customers decision-making.

So in other words which reviews will be more helpful and which reviews will be less helpful. Now if I know this information that this review is more helpful and this review is less helpful then using that information I can probably find out that if the particular helpful review is a positive review I should probably boost it up further. I should spent money on that particular review so that it get shown in various places through digital marketing or whatever.
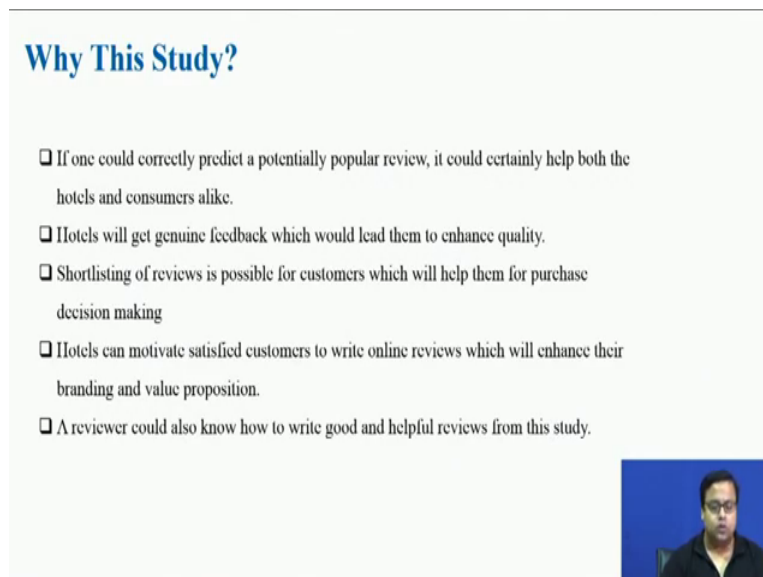
On the other hand if there is a review which is negative and which is going to be very helpful for the customers that means which is decisive and negative then I have to do whatever I can do I can probably call that review and say why this happen, why do not you change the review, I will give you better service next time this, that. So some service recovery mechanism we should pick up.

So if that particular customer is very adamant then I have to create certain digital marketing strategy so that the negative reviews do not get very much viral or something like that. So any service recovery kind of strategy, image recovery kind of strategy we have to take. So before we decide that which review, but then there is a negative review let us say which is not going to be very helpful.

Somebody said that this is very bad, I do not like this hotel that is all no reasoning nothing so that review might not be a very helpful review. So then there is no point on spending your time on that kind of a review. So it is more important to find out which reviews are going to be viral and then if they are positive reviews make it viral more, if there are negative reviews tries to find out that what are the causes why these are negative review and try to rectify that.

And sometimes it can be so messaging that particular reviewer is also involved when I am saying all of these things.

(Refer Slide Time: 04:29)

So why this study? If we could correctly predict a potentially popular review as I was telling it could certainly help both the hotels and the consumers alike. If I know that this particular review is going to be very popular it will help hotels because hotel can take corrective measures. How it will help the consumers?
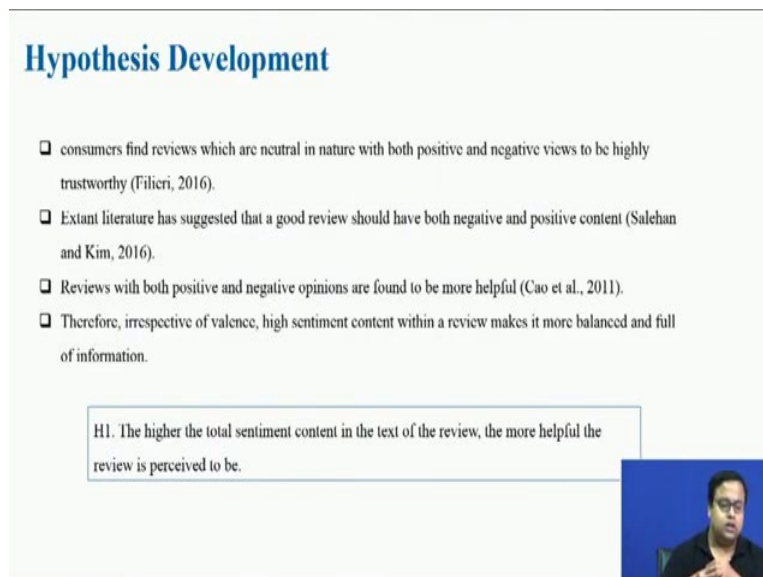
When a consumers will know that if I want to have my voice listened by my customers what should I do that kind of an idea they should get. Hoteliers will, because review writing is I would say business today. So you will know there are lots of influencer marketing guys who

sometimes write positive reviews about the product, sometimes is also negative reviews about some other products and get paid for it.

So that also becomes important of variable which ethical questions are keeping aside that whether this particular thing model that we are developing can be used in that context also to know that okay this review is going to be more helpful or more viral or more decisive and that reviews is less decisive. So that kind of decisions can also be made.

So going ahead hotels will get genuine feedback which would lead them to enhance quality that is also important. Short listing of reviews is possible for customers which will help them for purchase decision-making. So that is also an important aspect. Hotels can motivate satisfied customers to write online reviews which will enhance their branding and value proposition and the last one is a reviewer could also know how to write good or helpful reviews. There are various places why this particular thing can be applied.

(Refer Slide Time: 06:16)

Hypothesis Development

☐ consumers find reviews which are neutral in nature with both positive and negative views to be highly trustworthy (Filieri, 2016).

☐ Extant literature has suggested that a good review should have both negative and positive content (Salehan and Kim, 2016).

☐ Reviews with both positive and negative opinions are found to be more helpful (Cao et al., 2011).

☐ Therefore, irrespective of valence, high sentiment content within a review makes it more balanced and full of information.

H1. The higher the total sentiment content in the text of the review, the more helpful the review is perceived to be.

So keeping that in mind we have created certain hypothesis. For example we told that the higher the total sentiment content in the text of the review the more helpful the review is perceived. What is total sentiment content? I told that there is positive sentiment or negative sentiment both right. Now total sentiment is an addition of positive plus negative. If you remember in the last class we did overall sentiment as positive minus negative.

I am not saying positive minus negative count I am saying positive plus count now. So positive plus negative means if let us say if in a text I have 10 positive words and 15 negative

words then the total sentiment content is 25 that means anything that I am expressing good or bad rather than being neutral I am saying I am putting my opinion in 25 aspects or not in 25 different ways.

So that is something which I am saying is helpful when people give very neutral diplomatic answers those are not decisive reports or decisive reviews. When people give very much it might not be biased, but very opinionated answers that might be decisive. It might be positively biased, negatively biased or neutral in a overall sense. Overall sense let us say somebody is talking about very doing a critical analysis of this particular training program or this course that we are doing.

They can say that okay this is very good all good, good things which are positive which is also decisive all bad-bad things which is negative which is also decisive, but or probably balanced both positive and negative, but he is not giving diplomatic answers. He is not saying that it can be good or bad he is not saying that. He is saying specifically okay so this part of this things are good, this part of this things are bad.

When people specifically say all these things then overall sentiment content not the overall sentiment, but the numbers of words which are related to any sentiments goes up. As number of words which are related to any sentiment positive or negative goes up that particular review becomes more helpful because people want the readers want opinions, readers do not want your diplomacy in a review they want your opinion. So as long as you are giving your opinion that is increasing the helpfulness of the review.

On the other hand if your opinion is very polar if your opinion is all the positive opinion that you are giving is only in the positive side or only in the negative side very much biased opinion will create a less because then people know that okay you are probably paid or you are probably very angry with this particular service provider.

And wending out your anger here. So all of these things might not be taken into account positively by a reader. So that is why I am saying that the higher the polarity of the text of the review the less helpful the review is perceived to be. So that is also important. So you have to write lots of positive and negative things, but you cannot be biased you have to do a balanced in both of the way.

Hypothesis Development

❑ Reviews with high sentiment content and with neutral or low polarity would be judged as 'best reviews' (Salehan and Kim, 2016) leading us to our next hypothesis:

> H3. The interaction of review sentiment content and review polarity will have a negative relationship with review helpfulness. As the total amount of sentiment increase, the negative relationship between polarity and review helpfulness gets weaker.

❑ The title acts as an important source of quick information, which consumers could use to reduce search costs.
❑ Highly polar title sentiments could lead to distrust towards the review, thereby making it less helpful
❑ This effect is expected to be stronger for title polarity than review polarity. Hence, we hypothesize

> H4. The higher the title polarity score is, the less helpful the review is perceived to be.

Then what? Then obviously the interaction of these things has a negative relationship also. So your positive reviews goes up, the overall review content, sentiment content goes up you become helpful, your polarity goes up you become less helpful. So polarity is high and high sentiment that means you are using lots of only negative, only positive words it will be further more negative.

So the interaction effect, the multiplication of polarity and total sentiment content will have further negative impact on the review helpfulness and the same applies for the title also. So if whether it is a text or the title polarity is not good so that is obvious. So these are the first 4 hypothesis that we are dealing with.
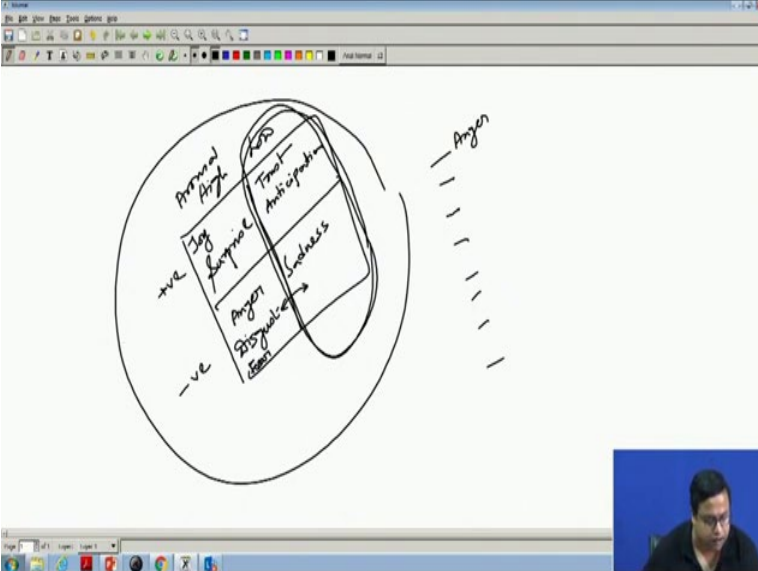
Next what? Next I am saying there are different kinds of emotions. In the last class we discussed that there are 8 kinds of emotions if you remember and this 8 emotions are what they are 4 positives and 4 negative emotions.

Now we break it into arousal, high and low in this also. So if you remember the positive one was anger. Anger is the high arousal negative. Disgust is a high arousal negative. You want to do something when you are angry you want to harm somebody. When you become disgusted you want to shout loud. So these are basically high arousal it makes you to do something and a negative emotion.

On the other hand sadness is a low arousal emotion of fear, fear is also higher you want to run away. Disgust might be both it is a continuum I am not saying very. So probably if I just put it in this way then disgust might be in the middle of this thing. On the other hand when I talk about let us say joy. Joy is a high arousal okay and let us say trust is a low arousal positive, anticipation is low arousal positive and surprise is also high arousal.
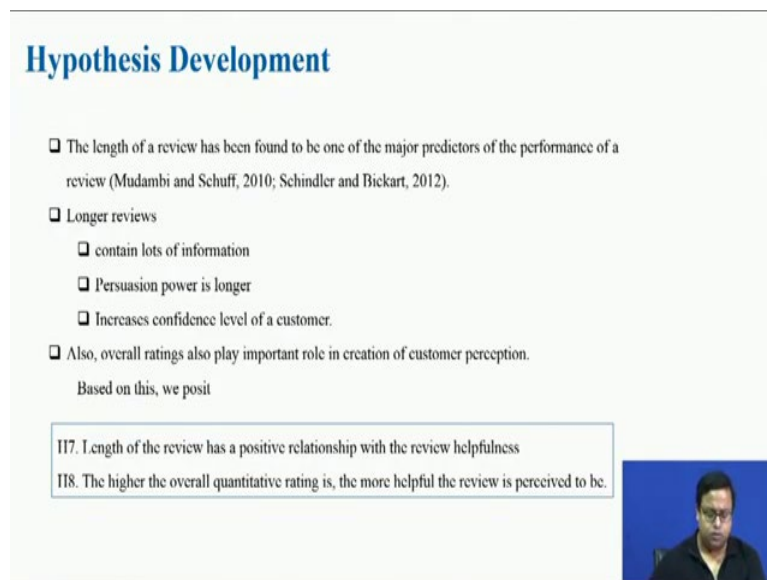
So we can break it in this way. Now here I am saying that again this low arousal stuff and less contributes towards the decision. Low arousal stuff is very much personal. It does not affect if I trust somebody does not mean that you should also trust that person. It is very personal feeling so on the other hand anger or joy or surprise is very much action oriented and action is something which impacts other people as well.

So high arousal emotions might have higher impact than low arousal and also we have found out that high arousal negative reviews might have further bigger importance. The higher the emotions associated with negative valence and low arousal the more helpful the review is. The higher the emotion associated with negative valence and high arousal expressed. Okay so this is opposite.

I am saying that when things are negative if it is a negative valence and high arousal that means like disgust, fear, anger we do not take it positively because as a reader I think that is a personal experience this is not something that is actually very common. On the other hand if by chance this particular review is negative and low arousal like sadness.

Sadness is more related to expectation disconfirmation theory that I expected something I did not get that. So that might be more helpful to understand something. So that is how we can take a route that how emotions can impact the reviews, review helpfulness.
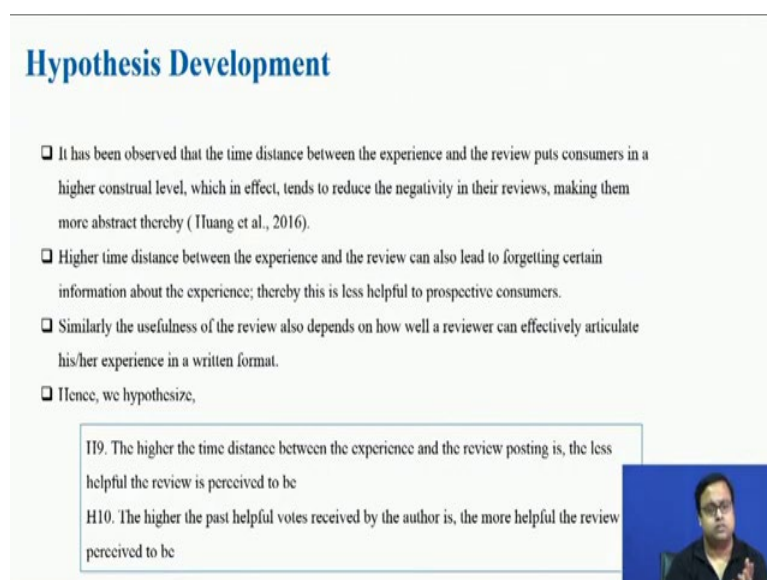
(Refer Slide Time: 13:55)

Hypothesis Development

❑ The length of a review has been found to be one of the major predictors of the performance of a review (Mudambi and Schuff, 2010; Schindler and Bickart, 2012).

❑ Longer reviews
  ❑ contain lots of information
  ❑ Persuasion power is longer
  ❑ Increases confidence level of a customer.

❑ Also, overall ratings also play important role in creation of customer perception.

Based on this, we posit

H7. Length of the review has a positive relationship with the review helpfulness
H8. The higher the overall quantitative rating is, the more helpful the review is perceived to be.

And the last is the length of the review obviously the mode of the length of the review it will have a positive impact the mode is the review helpfulness. So we need vivid description so the more you write the better as simple as that and so as I told length of the review has a positive relationship and the higher the overall quantitative rating is the more helpful. So we generally have a positive bias, positivity bias. So the rating that you give the more rate is higher the more people read it so that is why they get more helpful thoughts.

(Refer Slide Time: 14:32)

Hypothesis Development

❑ It has been observed that the time distance between the experience and the review puts consumers in a higher construal level, which in effect, tends to reduce the negativity in their reviews, making them more abstract thereby (Huang et al., 2016).

❑ Higher time distance between the experience and the review can also lead to forgetting certain information about the experience; thereby this is less helpful to prospective consumers.

❑ Similarly the usefulness of the review also depends on how well a reviewer can effectively articulate his/her experience in a written format.

❑ Hence, we hypothesize,

H9. The higher the time distance between the experience and the review posting is, the less helpful the review is perceived to be

H10. The higher the past helpful votes received by the author is, the more helpful the review perceived to be

So this is something and the last one is this is also important that the higher the time distance between the experience and review posting these are quantitative information still now the

sentiment, emotion, polarity all were coming from review text, but overall rating that I just told was coming from the quantitative this is also quantitative. In a review I told in the last video if you remember there was a date of the review and date of the travel.

As this distance goes up so let us say you posted a review within 2 days of your travel versus you posted a review after 2 months of travel which one will be more helpful. So we as a reader know that fresh memories are more helpful. So if the distance of the travel and the distance of the review is lower than the travel then it becomes very important variable that okay so if it is lower than it might impact the helpfulness more.

So the higher the time distance between the experience and the review posting less helpful the review is perceived to be that is also important and the higher the past helpful votes received by the author is the more helpful the review. So if the author is more trustworthy that means in past he has got lots of helpful votes then this particular thing will also be helpful. So that is not a casual relationship that is just a correlation we have to control for that.

This author is anyway writes good I would say reviews. So I have to control for his writing ability so how I can control for the writing ability of this particular person? By checking that whether he is anyway get more helpful votes or not. If he anyway gets more helpful votes then that will anyway have a impact on this current particular reviews number of helpful votes so that has to be controlled.

(Refer Slide Time: 16:35)

Fig. 1. Theoretical Model of Review Helpfulness.
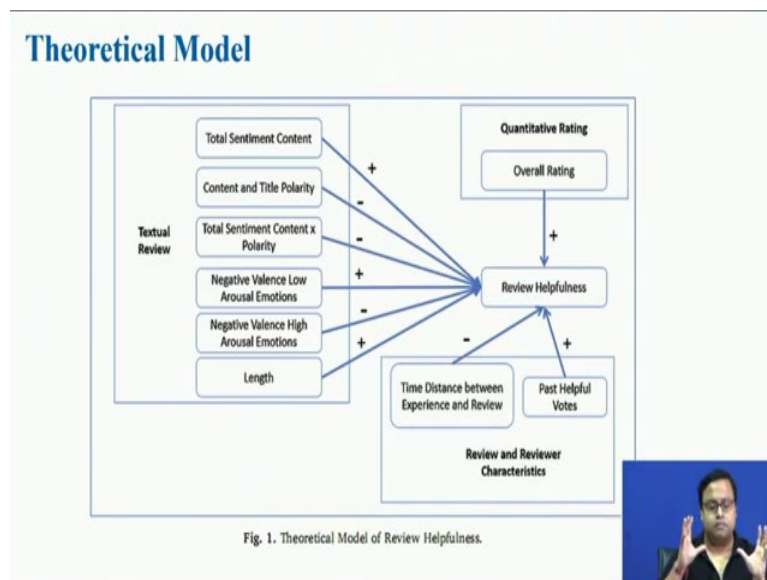
So these are various hypothesis that we have developed, this is the overall distance, so review helpfulness is our y variable and some things come from text like total sentiment content, content and title polarity and the interaction effect of that then negative valence low arousal, negative valence high arousal both kind of emotions and the length these are all for text part. The quantitative ratings comes from the and then some reviewer characteristics and review characteristics.

Reviewer characteristics is how many past helpful votes he has got and review characteristics is the distance the time distance between the review posting date and the travel date all of these things we have brought in the model and try to predict and explain review helpfulness.

(Refer Slide Time: 17:19)

Regression Equation

Review Helpfulness $= f(\beta_0 + \beta_1$ x Review Length $+ \beta_2$ x Review Polarity $+ \beta_3$ x Review Sentiment $+ \beta_4$ x Title Polarity $+ \beta_5$ x Overall Quantitative Rating $+ \beta_6$ x Time Distance Between Experience and Review $+ \beta_7$ x Disgust $+ \beta_8$ x Fear $+ \beta_9$ x Sadness $+ \beta_{10}$ x Total Past Helpful Votes of the Reviewer)   (1)

Review Helpfulness $= f(\beta_0 + \beta_1$ x Review Length $+ \beta_2$ x Review Polarity $+ \beta_3$ x Review Sentiment $+ \beta_4$ x Title Polarity $+ \beta_5$ x Overall Quantitative Rating $+ \beta_6$ x Time Distance Between Experience and Review $+ \beta_7$ x Disgust $+ \beta_8$ x Fear $+ \beta_9$ x Sadness $+ \beta_{10}$ x Total Past Helpful Votes of the Reviewer $+ \beta_{11}$ x Review Polarity x Review Sentiment)   (2)

We used both Poisson regression and negative binomial regression, and have done a comparative ana
the results.

So this is our basic model. So the extra variable that is coming up in this particular thing is basically the interaction effect which is extra over and above the previous model.

So we use tripadvisor.com. There were 942 observations of 40 hotels in to 1 to 5 point scale we used text mining technique and as usual we used Afinn to find out the sentiment and NRC Emolex to find out the emotions and this are the 8 emotions that we have got and these are the mean and standard deviation of the variables some descriptive statistics.

And this is how the regression works. So we did Poisson regression 1 because see this is count variable right these are all count variable which is the number of helpful votes. So for that we use Poisson regression and we have also used negative binomial, negative binomial applicable for count variables while lots of 0s are there. So most of the reviews has not got any votes. So if you see that average helpful votes in this review the mean is 1.63.

The standard deviation is 3.58 which is pretty high. So I cannot probably should not do a Poisson regression here we should do a negative binomial regression and that is what I have done because Poisson regression the mean and standard deviation are same and here what I found out by this analysis is that first of all the RC is what review content I will just let PL stands for polarity.

So polarity has a negative effect we are getting it here fair enough and then title polarity also have a negative effect we are getting it here and here also. So H4 is supported H2 is supported. Overall sentiment does not have any impact. So this is practically not significant and RC is the length that I will discuss about this thing. This has a important RC means the length of the review count basically length of review how many words are there in a review.

That has negative significant we thought positive, but it is negative so it is opposite not H7 basically it is opposite of H7 is what we are getting. So that I will discuss later and overall rating has a positivity bias fair enough supported. Now time distance has a negative impact very small negative impact, but still supported and DSG that means disgust, disgust has a positive impact which is supported disgust is a probably what I can say.

Okay so disgust is medium arousal so I cannot say H will be supported or not, but sadness I can say because it is actually low arousal. On the other hand fear is negative and fear is high arousal, high arousal negative valence. So this H5 and H6 is supported and the last was THV, THV was I forgot that and this is basically the interaction effect, interaction effect is also supporting.

And THV is supporting H10 let us see what is H10, the high the, past helpful review. So past helpful review also has a positive impact that means as the guy is more helpful in general the number of helpful votes in this particular review will also go up so that is also supported. So basically H1 is not supported out of all these thing and H7 is opposite.
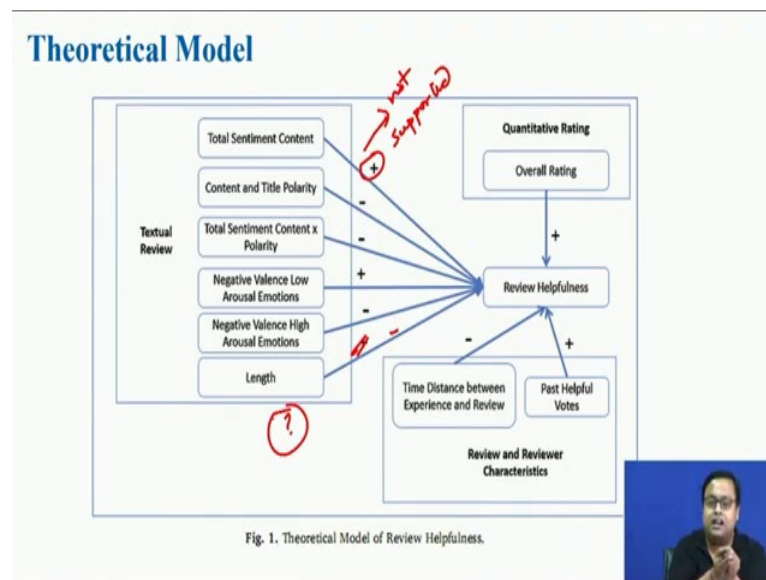
So to be precise this H1, H1 is not supported this is not supported and this is negative. Why this is negative because this says that basically now our understanding says that after doing this analysis whatever those were hypothesis that were testing. Hypothesis might not be true always. We have to check that whether they are true or not. So after doing that I found out that there is no point on writing a long review.

After you are told all of your information that you wanted to say, you have expressed your emotions, you have given the polarity and sentiment and etcetera controlling for this just blabbering your experience has nothing to do that will not make this particular review helpful. You have to give very much lots of information, opinions and information which can lead to certain decision just writing this much long review giving your experience.

Nobody wants to know your experience, nobody wants to know what you ate in the hotel, where you slept in the hotel, what you did in the hotel. They want to know that whether the hotel staff is good, whether the food is good they do not want to know that what you ate and whether you enjoy Chinese or Japanese or American which kind of food. They want to know that whether those foods are available and what is the taste of those foods.

So give the right information in the review, do not give a travel there is a difference between a travel blog and the review and a reviewer has to understand that. So that is something that becomes important.

(Refer Slide Time: 23:19)

A polar title would lead to distrust and thereby making less helpful, negative emotions and low arousal has in fact higher helpful course. The study suggests that overall quantitative rating has a positive and significant relationship. Time distance will have a negative and significant relationship, the result suggest a significant positive relationship between past helpful votes received by the author and review helpfulness and we also found that higher length of the review takes leads to lower helpfulness.

So some of this understanding we are getting from this particular. We also tried to check using Poisson and negative binomial to check that whether the results are.

What are the managerial implications? It gives an idea about idea how to predict prudentially popular review. So we can use this model we have used in this model actually in the predictive model also. We have used random forest and decision tree and normal regression to check that which one is doing better prediction and we found that boosting or random forest is giving the best prediction.

But these are not very we have also used ANN but regression is not giving very bad result even in the predictive thing. So that is okay we can go ahead with regression. So by saying that I am saying that I have created predictive model how to predict that which review will be high or low that predictive model was created by this particular equation that we have created and information about the drivers of review helpfulness is important for sellers.

This information will help them in review solicitation process. They want to know that and which they can use to promote their business and drivers of review helpfulness are also important for a reviewer who can get information about how to write a good helpful review. So it can help a reviewer and it can help a business. So both it will help so that is all for how we can apply this thing in various contexts.

And we will be discussing about every little bit brief about topic modeling in the next video probably and then we will go for week 12. So thank you very much. I will see you in the next video.