### CG\_week4\_lecture3\_1-20240923

说话人1 00:00  
First, i'd like to introduce the cost project. So have you read this pdf file after to tense? So you have to start for more details for several people post project. So this cost project is it's a research trading project. It's like, yeah, and then you have a 700 students recently searched that the computer graphs to make that topics is it can be an early place faster for three models and possible. Thank you. So you call it. Studio on tv comment generation in beijing. Tvoc is used to introduce more on the first agency. It's hard and you can expect anyone either. One, if they you are interested. So you can select any parties. It can be compared based on elements. Computer practice, related topics. So here is some reference. So that do some during the cda process, it can be better figure it was 2 . 5 differently for us to be changed the screen dash.

Also the list of that's more usual learning. Let the nerve you are really confused. So you have have to speed up the numerous process and how to speed up the training class. Also the $3 spend. It is a new example. What should indulgent strategy is also the it really is good.

It's really good, but not usually no. You are like what the chips are connection in the following lectures, in the final tomorrow.

And the final tomorrow is a little introduce in today, lecture will give you the difference in possible point of view. Also that in the three content generation are unique part of the generation. It's also okay of two generation, three generation. So this is some topics. Sometimes for the reference, you feel search the behalf. So there is a this is some projects and agents summarize the different parts. That's unusual. It is few. And if you search the bihar. So that is the papers. And recently, you can read the paper first. You have a second one paper that you are interested, and also to check whether only the public is the public people. Most of the public. You have other. So this is a requirement for this. The group members. A is a project can be individual group base. So each group, the members up to three. So I think most of you is about it is fine, but it is you can have a real kind of project.

I also send you the new graph. Did you raise the senior union? A there is a link. I send it announcement through cameras. So you should check your email. I yeah, so you should check your email revenue. I send the information three dn so you can use the patents, do the patents, the announcement so that the name, so you can adjusting the group. Just read your names online part. So if the group is three, it's kind of a higher level. If you have one word about 2 pages by that comparable to the individual, find that. And they have great may not require. So this is the basic requirements, the basic requirements that first, yes, the part you should submit a new part I the sub part ok actually included the follow back of the international project and deployed determining environments, the demo code and training model, and compare your result is to provide that responding in a bad badly produced the the result, showing the tape also.

You can analyze moment, analyze what's it? I don't or whether also you can implements compared with other skill or other method. This is a basic requirement. You can read this file, make it for marketing is I want to find it, we will take a 20 percentage.

You are expecting this kind of this time. And if you can go to in the performance. Yeah, so it will be most of you, but both are new ideas you have to. It's not enough. It's not possible. If you can compose, it will be great. But if you provide even you can slightly change the algorithm, improve them. Equal government is okay, because obviously you have no experience about the project. I just encourage you based on the analysis, right? If you run the code. Yeah, you understand the people understand the average how to test it, how to propose solutions, address the limitation of that. Is that if you can obtain higher performance, right? It's fine. You just probably reasonable. Expectation is also a ..

This is a 29 how to analyze in a topic in a an hour to 19 several research experience, probably in that research. So giving a paper, you rather know about your results. They don't know. Based on the result of what can you offer, what can you can do? So based on how to address it, if you can hold appropriate solution, it's fine. You should provide your explanation also for. Yeah, so do you have a presentation for the last lunch? And we are also each group of your. Yeah. If it's a good place, I guess you probably have a 19 students. So we will have at least certain groups. So each group will have a 7 years ago. I think 7 minutes about 6 days for meditation, 2 minutes for 20 minutes. The presentation is the last one. The last mention is december.

So after the presentation, so you can still modify project. So you had a a new part based on the feedback. You should look at this part. The submission deadline is to be summer, middle, summer. This is the last the last day before information. I remember the last before the examination and examination. So later we will set up the submission link in canvas if you have some new products. So finally, they are qualified as part of data payback. We see the issues. So it's about in a program. The problem, just some problem is so the market, yeah, the market is it possible way to be the 25 to the final on us a factory of this part. So here is reference as a large number of some resources and resources.

If we can read this lecture, this pdf file for more details, and you have to targets, they have you out of it are standing, right? The lack of the here is the kind of high march and that's a low our studio detection. And you will rendering regeneration. Also, a geometry recommendation. I see aa look, how is the forest type, right? So you can read about. So the department will come back in times. They have to complete the project. Also, if you can have no experience, again, let's start with the party. You will understand. I have a a question about possible in previous years.

So even the experience, this research topic. Yeah, you previously and I also found some very good, even there's no new idea. It's fine. But if you do not provide aaa conference analysis, it's fine. What's the limitation? What's the advantage based on your understanding, based on your understanding? Get to that the recent programs and recent products history, not it part of traditional ground. Issue markets is the packers is the plans are so passive before black news. Good for you, ok so if you have no question for in this lecture, we'll give you to extend the difference in the sea of this process.

So like the three big three mash, it's really bad for geometry. As I mentioned, a geometry data, they are different for them. So to find out there is a low recommendation, it is rocky collect the street management in this recommendation. As a long case, on the broadly, we can read each other to be matched, and you have whether to be matched to be in case of your application, different kinds of representation in the secondary government.

The second or third development is still to be. The team will introduce, particularly if we focus on that implicit worker, how do you use the referring to in, basically, like the scientist function and the articles outside use the function? This lecture, we introduce them first. Probably the cda the recommendation that is a regular. I we can give us to the object, right? We can be the regular question. You can project the three object that was different perspective, right? We have produced a set of images here. This is a set of working plans about the weather. This is as a multi union, right? As both of you, maybe we can do the referee inside the budget camera from the referee. We will produce a set of images. We can use this part of the image to do you have and is object. So also we can use the workshop, right? We can use the workshop. And I mentioned in the the lecture last lecture, the workshop of the conditions is an extension picture in sydney space lab.

We just indicate which function is that occupied to reach out to the occupied. You can use 01 prime is 012 indicate. But here you have seven. If you use a function as a resolution, it is not high enough. You will observe the it's possible, right? The service is not, it it is not continuous, it's not continuous. Vsl there's obvious distortion, right?

So this is a regular reference. We can. But for the irregular domain, we can use a black card, the raw data. Yeah, also, we can use this as part of the match, but part of the match. So is I interviewed it last is a collection of vertices, edges, and face it, right? Is that you can use the whole region for my plans, give a list of faces and a list of edges, or a list of faces, a list of approaches. Right? So this is the format. And for if there's no connectivity, the raw data is a point out and rocket and point out just a collection of 3 points. The 3 point is defined by the city quality. It may associate with may be associated with them, attribute information. So the attribute information it can be a color information one associate with each time. The normal information as soon as it is time. So the format is a the number of buyers. It's a 2 ° and these two be agreed.

So if they are in total, there are numbers for point out the sale in the rules. And this argument, the three xyz it will be an times three matrix. It will be an times three matrix. This is the data format ok so here we can compare the image, the difference between the two d image and the 3 point copy.

So the left, so this is a two d image, is two d agree? It's a two d for the two dna is elimination information. Is that the information? The picture is rather than sample the are they living space? Why do they exist? What is the normal living space? The euclidean space is shorter, distance is aa a straight line. This is delicious is a buffer to find out. It's a geometry. This the image is in a relationship. It's likely person. But why not? It's a geometry formation. Do you illustrator swedish, the geology architecture? We could a is a industry coordinate if you rather sample the on the normal business. So the normal is exactly the plans are distributed. You revenue over a surface. That's it. If you want to calculate, these are two parts over the circle.

You if you want to find a short distance in euclidean space, you just calculate the You read the distance, right? But in the home of the service, and I have given this part at this part, how to find this, that this must be line over the service over the surface instead of just draw a line, connect the two parts. This is the imdo dot lying on itself. Here you have a discipline, that's the distance. You have to find a line over the surface to indicate the shortest distance. This is a there is an option. So we can. So must I give you what's the difference between the this is a the highlight of why the invasion language challenge. So must ask you, if you go check the two images, right? We can the two image can be shot five dimensions. Here, we can see that on rtv data, we consider the rtv data, the rtv data. That means for each picture, it has artv value. For each picture, we also had a two d partner, a picture, final notation, right? We can use your way here.

So the picture, sorry, you made the time is shorter as a collection of five dimensional part, right? The first three dimensional is rgb value, indicated the picture value. And the uv indicate the location in the uv right? And for pointing out, for ￡5 is just a set of three points, right? The defined by the x minus in three d loop in three d space. It's a three conditional signal, this x by the information. It will be used the process as a signal.

If you process the shipping ., how do you process this value exercise values? If you want to find the neighbors right in the previous lecture, I mentioned if you want to find the neighbor, right, let's say you give a fine.

If you want to find out the neighbor how to find out the neighbor, you can start so a in a local reading, and you show up then it is this, right? You have to have the pds neighbor, right? Calculate the distance and find out the top smaller. That if you want to find three neighbors, you can use a three smartphone distance, right? It will be the neighbors. So that means this value, it will be process of the signals. And also, you have to use this value to index the neighbors. But for images, if you want to find the neighbors, right? So you just based on a two d card and to be located on a picture party. And if you process the data, you just process are to be valuable. The rgb value, you will process, you conduct a conclusion to converge. Reason rgb value instant, you will find out the neighbors rise.

If you want to give this picture location, I want to find out the neighbors. You just check the new visa as an integer, right? Into the integer. You have passed 1 - 1. You will find out here is a difference to summarize you. In, he said this is the point card is a be quite unstructured for images structure. The structure is defined by the uv coordinate in the two d but for coin crowd, if a coin probably quite unstructured, we only know the three d coordinate. We only know the three partner a it's a challenge.

So the unstructured nation, a challenge of development, deeper model issue there, ok so this is the fundamental way. Why is difficult? The process is reading that? Because there's no such as the xyz the data. It will be used as signals. The data will be sent into the will be fairly to the network, right? Also, you have to use this data to find the neighbor information to perform the local information of relation. But for image, this is a signal, and this is an index a this is a common difference, also for of a fine product.

So here I give you more experience about the us letter. If you remember that is, as I mentioned, the previous page, the pictures is regularly distributed too deeply, the regularly. If I go to find out, so it's just aa several points. Revenue is it's really the over service right here. We can start to find out as a two d two d array. This is different from the image. Then this two d array is different from that of image. Here, the number of rules indicated the number of points.

If there are other points, we will have a 2 year will, then rows here, three indicate the three coordinate exercising is 3 columns, ok and on others, here, another is for given image.

If you change the location of two parts, sorry, if you change the location of the pictures, so the content will change, right? It may not be aa physical, immediate image given to the image. You renovate to the pictures. All right? So the possibility, right? It may not be a physical, meaning. It may not be physical, but it will find out, even in choosing the order here, are you this image? You should this be choose a so that's it. We have a 3 point, right? So the point is starting the first part, the second part, the third one, right? Even you change the other, we started this p two and the first row, p one, and second row and p three, and as the third row. So here we can to organize the clients in different order, right? But actually, it's still the same part. If you illustrate it, if you illustrate the pipeline is really spaced, it's still the pipeline, still, the same object. It's still the same object is this is an order list, ok for example, this indicator, the body, right? It contains a 100 twice.

We could you, if you just randomly assign a number in that point, the first one, the second one is 7 .. You can all organize the points in random in any order.

If we will not change the three d coordinate, it will not change the quality values, right? It just changed the order. But if you illustrate that, put the data in three d space is still the same object and see the same object. So this is an element, but for quite for image, right? But images for each ee picture, it has a to be part of that. If you exchange the location of the pictures, the partner will change, the column will change. So this is our order. The third one is the location in paris. Okay? Rotation invariant one is the major rotation in various give us the object. So you can probably rotation randomly. But this is still the object. If you design a network, you do the classification, right? So the objects can be correctly recognized. If you randomly take the object and feed the object to the network, I see most of that one. Give us a wrong result, give us a wrong answer to china. Also, this is the normal mental, fundamentally challenging product.

Ok came up find out if you apply the studio location, london is object a little bit, right? That means that's really hard to change, right? The three argument will change if you fit the rule, the change object in the model. I don't mind. And the classification efforts will increase if is that those special is that data, which it will be a running as fine.

So this is a location. If you design that one, it should be location, environment. It should be a location that also, it should be communication, right? Permutation in front of that means is that there are people find out, right? You can take it in 10 to 100 points. Iii think the crime is connected in different orders, right? So it should be correctly classified. And if it's a classification that way. But if you change the order, I have figured them, I feel the change is a feeling the first point, the second point that is fine in different orders. If the level are running classified them, the model that is not good, because the same object, it's the same object.

So a this is a difference from community on the tree. You can track. So how to design the the deep on the tension for three part of that here. This is a in the past cnn right? I used to do that one, right? You have to be confessed, so you can confess the following. Have you been the proceed previous? The convolution of your network? It may be contained the following the form he module map. He said, so the first one is conclusion, right? As a convolution is a to pollution for local information, but improve the to improve the images. It be a high traditional features. There will be an evolutionary partner. You should have a position. And if you find a position of parallel, for example, it is a part of me, right? That this is different pollution.

Good. Improve the picture from a feature, from the image space, hydrogen features information, and also from the local information revision, right? And from a local good information revision, is that so here you can observe this is the final set, right? He has a picture covered by these colors will be weighted and combined, right? Will be waiting some. So this is a local information application. This is a little bit provision of religion. The second in partner operations that fully it's a the pulling operation is here, reduce the feature division to reduce the patient emission. Here this is the article you can write. Here we perform the pulling, because for the image, a is a distributor is a on a regular 2 °, right? So you have performed the next pulling, the average pulling, right? Because we know the structure for the next pulling, for this, for neighbor, you select the master there.

Okay, so it's quite easy, quite simple, or you just sample one rule, sample one column, every other part column, just drop the column, the even column on the all columns. Right? It's quite simple because the we knew the structure, the polling operation is also possible.

The third one is a deconvolution, so deconvolution is so here for we apply the cooling operation, right? Reduce the dimension. For example, the input is a high resolution image. After they put it official side of the division, we will reduce significantly. If you want to perform the segmentation, the unit segmentation, we have to increase the feature commission to the original resolution, right? In this way, each picture will have a label, right? That means you have to perform the deconvolution.

The evolution to increase the official dimension, to increase the official dimension, so that this one, this is a after the polling. So here we are in the feature dimension reduced significantly. And we have to do the deconvolution to improve the feature into the original resolution. Ok here, this feature dimension, it's the same as the image resolution. Then you got 107 page. So each picture will have a label, right? Each picture will have a label. This is the side, this is some of key modules, is the key module, is our key operation in three pollution. It is similar to the last one is the last function. The third, the last one is the last function. Like if you want to perform the classification, right? If you want to perform a classification here, each picture we don't have a label, right? So you use a branches to supervise.

And so if you want to put on a reconstruction, this is about to include them given the input, this is a bottleneck reader reduced and reconstruct the image. You have to use the fsd loss, right? Use the input image to supervise the, how could you calculate the difference between the output image and input image? Here, you come with a large function. It's quite simple. Why is it quite simple? Because we know the response one. You just calculate the difference between two corresponding pictures.

That's the first picture of the located in 11. Just calculate the corresponding with a similar patient, right? We know the responses. So it's quite simple, but for point out, as I mentioned in previous lecture, even 27 points, how do you know which kind of you a i'm not b so how do you know what private you find? How they respond to them? Which pilot might be? Right? It's not included, right? Not send for, but for pictures, but even to image, right? Given two images, for example, occasion 11, you make a and you need b if you want to have the difference, right? You just have, for example, the picture is 11 ea and the picture 11 would be, it just happened at this point. We know the correspondence.

So it's easy to compute the the difference ok the difference between two images. But for 5 hours, how do you come true? It's also not seen you have to use them because of the response of variation in this. The response information is missing. So we can only we can do the previous site, especially the chance for additional as for this emb a it's we don't know the response. We can build the response.

The first step we will find which point is this part, which point they find the responding the respondents to calculate the instance between the corresponding part. This is a if you can designs is capable modules. He is the key operation, how the whole conclusion and how do we control it? How about evolution? How to design you the last function? We supervise the level of training, then you have if there is a deep architecture for 1 row, right? This is a analogy of evolution that so if you can design how to confirm convolution, but there's no structure information. So that is how to find the neighbor union, how to put the information obligation, the information obligation. You have to learn to perform the information communication. You have to consider the permutation issue. It should be competition environment.

Like give us several points for each class. You have a feature, right? You have a vision. Iii exchange the order, but after the pulling operation, the output of the patient could be should be equal, but should be identical. But if you change the order of the feature and change the order of the features, after the pulling operation or the obligation operation, the opposition trade, it will be wrong. This is when you design the obligation, you have to consider the computation issue.

Yeah. This is that you introduce how to design, I guess, from the tree, which I if you want to design acdi keep us up here for three d data. You just think about this for operation plan. Yeah, actually, so many people, I can tell you for 3 . 5 uses to design a composition, the motion of the composition after it for the revolution, because there is no structure. So just you have not in here, log in your perception process. Each point independent include data, the time from higher initial features to obligation. Locally, you can just do that either here and you find the neighbors. And revision is aa cooling operation is also that maximum in each dimension. To find the friends the past average, compute the average, compute the so maximum that is competition and is probably the combination is the information, the evolution.

Here this is the map. They have to show you the some task, a as a task of deep learning. The public area for students also provide you some applications as a classification segmentation outside the downside world, also the competition.

So here we consider the in this lecture, we focus on quite a bit more. The crime is a result, is a big process of crime and we have a big process. Yeah, so actually there are other free ones. Next workshop. We can convert the the price of the workshop, but it will introduce discussion. It will introduce this partial, then what should I use? And after that a it's a quantization process. It is a compilation that will introduce discussion. So here we focus on private result trying to be the framework that is given point out. We process the data without any pre processes. That means it's not good enough. We're talking to the pilot power process even directly without any additional three person. Yeah, but here there are more. So here I only listed them some repetitive works that before 2022.

So actually, the recent years there's some what is that? Is this year there are also the big arguments with the possibility that from ok so the first one, yeah, I think manager will the process if you select the target, the big point part of us. So this is the first tiny and tiny developing years, 2017.

So this is the first. So nowadays, if you if you look at the problems I simplify, but at that time, a a it's a difficult to construct like to to make this that problem works mostly. And you can try, ii think the they also went along how to make this that world and process the data I the accuracy can be higher than the accident.

Ok so it's not easy for anyone. So for this, the finance, we kind of finance. This is the first order. It's the first deep architecture to process 100 in 7 years ago. Here I would have to introduce the some other key operations.

So here, process summarize, is a private share, multilayer perception, mlp it to process each quite independent, the process of each part is independent. That is so given a point, probably in parts, right? That is a vector, xyza vector, this transformation is aligned. You can align them that hong kong just to limit the rotation. And we can you can take this as a patient. The transformation is this. Actually, it has selectively improvement, and you're not contribute. They actually want. This is tina ok other is skills of after transformation is zero point. So here this is mlp ok the mlp can be shorter as a convolutional convolution. We are a kernel side of the 1 times more. Ok the kernel says at 1 times all, these are so fully connected to me. And how many of these are fully connected to me?

We can improve to the high to the feature space. So to improve each point to the feature of the dimension, 64, this is a different ideas, okay? Different ml ps finally to improve the features to 1,000 number, 24. Each part that you will have official dimension is 1,024. For other points, we will have other features. We will have other features. At each point we will have a feature method. This is the polling operation. This is a polling of in a global vision.

So why is the heart of the global? As I mentioned, if you perform the cooling operation, it must be competition, right? A this is a in total that each vector has the dimensions once on the and 24. Right? So this problem is that you compute the average or select the maximum, right? You may change the order of the features, so that each part of the maximum value will not change, right? Or the average will not change. So this is the presentation invariant outputs about in a global vision. If you want to perform a classification, you just use another about the or the fully connected leader out of the restaurant, the class limit. And if you want to perform a segmentation, ok so that is the endpoint, right? For each point, you have a particular label, right? That means, so we have to increase. So this is a become which matter. So increase the global feature to the, for each part we will have official.

So here this one is quite simple. It's just compassionate, the global official with each a way we should find vision so far in this one and then use another analogy. And you ask me for each partner would be asked for label. And we are available. So this is the overall, this is an overarching picture, the overarching for china. Okay. So now maybe more details. We have volunteers about this architecture. This is amrp this is amrp for example, for example, if we input is the input signal, is a one times ad one, there's a dimension d one. For instance, the point power one is that the d one you can do 31, d one equal to three. This is we have ad two feature, the d two filters. Each filter on the dimension is d one ok each field of the dimension is d one ok you perform the this is a vector 1 times 3, and this is also 1 times three ok you weighted the combination.

Ok perform is a meeting voting as a this is the three values, computer, the product of responding value and countries, the sum, right?

You'll be out of the right here for each, because we have d two, big 3 times, right? It's all for the division in d two, right? The opposite commission would be to ok so this is the mlv so it's actually is the the kernel sizes can be shorter convolutional evolution of curve size 1 times 1, or the fully connected there. They are fully connected there.

This is a I just use of the learning on a single part, okay? Even it has ￡1,000, right? You just figure this ￡1,000 one by one. Just figure this 1,000 . 1 by 1 to do this operation. For each point is out of it will be out of one. The official one has been to right. This is to improve. If it's at n points, then i'll put it to n times d two. For each part, it will have a feature of size, feature, ok so is it clear? The feature in value is quite simple, okay? Officially valuable ok so the last thing is only five. Perform the pulling operation. This is a feature. This is a feature matrix for that. The feature matrix here, there are n their own point, right? Their own point, the first one, the second one, the third one, the next guy.

We will perform. We want to ask a a global feature ok for each feature. The dimension is d each feature that dimension is. So we just probably in the same dimension, it is identical dimension. You have a voice.

For example, this is a second. You can calculate the, after the average, or another will take this as a two d array, the size of axb you can take the second column, the second wu compute the maximum value, or the average. If you change the rules of this matrix, the maximum value will not change, right? The average will not change, right? The sum of it will not change. This. Pulling operation is competition environment. Right?

For example, you have to do the average of this column. If I change the growth of, if I change, this goes random, the average will not change, right? This is a communication, right? This is the right? This is a putting operation after putting without innovation, a global patient, what kind of food oka global patient one. So this is the maximum only to find out the maximum of maximum value of each column. If it's average column, which is calculated to the average column, if it's sum, you just calculate the sum, each column. It's again. So this is a featuring bargain. So ok so the key value, this model is a the transformation. So the transfer, the transformation, if you have the purpose, is that is it good? For example, the being the same object, it may have a difficult, right?

For example, you would in the data set and they for this object is a position if in the data set, another object in this course, but it's the same object with a different process. Actually, we expand the course. It will be alignment. We want to make it such as the the same object with different forms will be aligned. Ok so this is the begins of the transformation being is the transformation of tina. Tina is one. You that are transformation issues, ok we want to learn our transformation mission, modify them, transformation, which is you put data into a lot to another level. This is a this is the detail of the dinner. You just ask, you, can you show that with the self attention from the data, then the value and multiply the matrix to the input value?

This is a for example, given the point out the n times three, we use a multi requested to the in the official space is an times p and after the over the next food that's not doing, we are here a global fisher plan is one times t and we use another mlp to reduce the feature invention to 1 times.

Now, a one times time we call for the ship to receive it a matrix of 3 times. This is the transformation. They even made. We can realize it's like a serial rotation as a rotation matrix, is 3 times to that, all the translation matrix. The rotation measures the translation matrix. Is this a three d transportation? Then we multiply this 3 times 3 matrix to the meeting you will apply in the transformation. It's a purpose is we want to align different models, a lot of different models.

So this is the details of so this is the the finance and the key steps ok so here is the final for transportation and segmentation ok so that's that's a this is the part side of the nation and this is 70 %. This is classification to recognize they will give you the final part. It's a it's an object, right? So the price is as a mark of people come ok to class. I said I can give it a classification ok it's not giving. So this is the parts of the nation. This is the concept of the second a a is a that you could argue is a different. Everything is. This is the 670 %, 70 % issues that you put in the same data, decided to different semantically, meaningful part.

So here, can you what's this 1 page of finance based on my explanation? What's the what's the limitation? What's the response partner?

As I mentioned earlier, the process of each time in the event, this one, given them clients, just a process of each client. Here is this feature inventing one by one, 1 × 1. So what's the limitation? Can you observe the communication on the drive? Why is it possible you? Like? It's time consuming. So here we process each file independent one by one. You record for image differently for image. You apply the convolution. So that is the conclusion. Kernel size will be passed a for example, 3 × 3, the 3 × 3, the color will cover line, picture. Line, will cover line pictures. It will be the sums of nine picture, if you want. That is right. We also have that. This is a local information application as local information. Are you find that is about zeros? Did you find a session such an operation? Do you find such a that given time? If you find a such operation, if you this is the paper. If you find a such operation, we give you this local information together.

Here we just processing. Which part of you, do you have an opinion? How do you should have the right? And another vision? Put this one to find out here on another for teachers, one by one process, each one, what I want like independent. Right? No information we need. So for finding out for image, right? For image, that's it. A we use the color side of the 3 times we are. So if you, let's say this is not an issue, right? Corresponding a local reading an image, covered by the original camera, right? We're probably that's in the way that manual question that is abcd that's the cover side of the the weighted w one times a one, w two times bw three times c one. You feel that we have nine.

All right? Freedom we are preparing for. Some issue you will prepare them. This is the local information creation. This is the image, local image. This is the one you can get this. You just on the weighted operation. In the waiting combination, we are better than very good percentage output the receptive situation. This is local information application. You find product. Can you find such an operation? Fine. Only the last year, the global feature, only in the last day is a global feature. Bringing all clients to find that one right of here through vision, right? But so in the previous years, there is no information obligation plan, local information application, right? Each file will be a process that we depend. Right? So there was such a information application, local information. Then the final pass ok the final pass, what's called the previous the final. If you got the body of local business. Here, this is also the calculation.

The deconvolution. For this deconvolution is quite simple. Just copy the global fisher 10 times, copy the global figure anytime, then contact it as a contract issue, right? Just copy this one, go to feature 10 times and then contacted with the part of the issue. And compared with a part of sorry, this is the ok the part of revolution, 64. The final language is strong. And this is the one side of 24. So the only one side of the game just simply copy, and it may not be good. So this one is a it's a too disappointed that passed to me. A it's a conclusion program.

Okay, also, here you can observe in the finance. So actually, before the final year, before this operation, you put in that part, this data, the output is still unofficial, right? No polling operation, no pulling on it. If you use this will be maverick consumer. No pulling operation. If you put on that is a that is a this number here, the total number of each of the increase, we will obtain a feature number of those will be smaller than that. So no pulling answers. If i'm in convolution about, I just show you the evolution you have answer in different layers of feature size, reduce gradually, right? The figure seven is great gradually, but is this one of the future seven systems? So always an end. Right? There's no going on. But here we want to graduate use the future size. That means that we have, for example, right? For example, also, this is one another issue addressed in the finance address in the part by the final half past.

All right. Also is the finally is another difference is that the evolution, so is that a simply copy of part of the patient? So here it is. Based on the private location from the waiting. You give them a little feature and to interpret the vision. This is the key idea is, so the pay idea is actually a a private finance locally apply the finance. So that's the given finding power. Right? Here are quite hard. So here we can select some amplifier. You can you can keep this as the some key points, or other part, you may be the poor carry or other some real maximum five top fps fps to select someone, slap some on the farm.

For each on compound, we apply the finance. That is a private finance, local. Okay. Apply the finance. And locally here, you can upload it. Here is another the n one on the point. For each under prime. We snap when we choose the way we become the neighbor, don't be applied to find that, apply to find that. Locally here you can observe the feature size. You spend the input is the advice. After this year, somebody we are taking one, no one is smaller than ok we can apply the sample again to select amount of time, then apply the final in local.

Here we reduce that in the future size. This is introduce the sample. Ok interview is a sample to the process. In other words, instead of applying the point of global to the . to the input . out, you just select some on the ., right? Selects are compliance of private client and noble, a kind of finance and local. So this is the first one. So is it actually, this is a breaking and looking? A break is a little bit for the classification because it is the same.

Finally, I think the blue nation use the connecting there and how it is a prosecution score for the segmentation, if you want up and down. Finally, label, right? The final label is here after the sampling. The number of features reduce it. So we have to increase the number of features to the original resolution. For example, the team put it. In part, we have to interpret the vision. Right? We have to increase the number of patients in this way, each time we have each time. So here is a how is that about a duplicate? It is a duplicate official. So here we figure out the location. These are the location. So here for each of c after the polling, we are here for each client, there will be a feature line. There will be a feature there. We find another part, but if you want to obtain the other ones based on the geometry location, for example, the part is located here, right?

We will use the neighbor requires to make this one ok so that based on the distance, you can pass it as a the contribution to the futures. Kind of this is in the position.

This is in the college. You can give them college the features. It's clear, apply the performance sample, so that's not apply. Then apply the finance local to increase the official size. Okay? We can pay the job to the case of the party in a valuation. Here to introduce here is the pulling on the sample that you can do the random sample. But you can use a random example. Random is like the other part, but then they made the advantage to the the efficiency is very high. So give you a contest, but the limitations will be some the selective plan will may be not uniformly distributed. They are not uniform.

So if you want to obtain a uniform, it should be on the parts. We can do that. 5 . is ips it is constant sample investors. So what's the meaning of the hardest time as the name is? Each time we select us that finds the part ok so that's the given initial part.

So this time, we initially is so that london is never fine that here is this part of the remaining classes we want to. We want to select the next house that we will have to be the distance. This is a few pieces. We look at the distance pp there, and we will find which one of the five is it? These are distance here. We have better than py the father has a larger business. No, do you use that? P one, p one to the sack, the stack of the sack? Then from the union part is that why is to p zero to p one, right? The price from using the largest distance to p zero and p one. Therefore, this one is each one we will select the two sides. The selected side is the candidate, and we will calculate the price. The candidate is that to the side of the time, the distance real second of the plants are candidates are producing a large distance.

We immediately This one, we can select the uniform, which requires, but the limitation of capacity is very high, is an square. The complexity of x squared also is a very slow, but not scaling on. And also this this is an area of economy paradigm and can be interpreting parallel. So this is the limitation. So that's probably.