### CG\_week3\_lecture2\_2-20240914

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Yeah, because some students are very interesting among the reputation. So it is very pretty and he said you, how do projects such as those image you reference to demands? It's not, yeah. In previous I show you that is the idea is possible is intuitively how the power and how to put the 3 points into the two d image, right? That is put in the negative lines in the negative pictures. But actually, in practice, how do you think that this algorithm is a universe process? Is a generation process. And to up to put the price to the image in this process is a very challenging, is a carbon natural optimization, is a very challenge. But here we actually is a is a generation. This is a self supervised, self supervise the learning process.

And the idea is, so here we pretty define a 2 ° ok this is a small signal. This is possible. The data is just from a zero to that is a really that and the size n times, the value is a drama, one, 00, sorry, 11. This is a small signal, smooth image.

And so here we use the convolution of neural network for convolution of neural network based on the spectrum axis. So the network tend to be the low frequency. The attention there is a low frequency component. You can shout this, fix this as a low possibility. Yeah, but the revolutionary as well. Here I show you the small supply of them, the small input. This is a function. This function can be shuttered as a small function. If a small input to a small function, the output is expected to be smooth. Most of that is this invasion smooth ok so we can also regulate at the smoothly regulation. The smallest reputation is seven. You can set a picture that generated image. The center picture is equal to the average of a neighbor picture. If you minimize the element. So this is a small recommendation. And how to train this network to choose this is a different model. This is a bit of this with minimal distance.

Ok as I mentioned, each case shows one part you, just like the picture as put into the three d space. It's a several point out. It's a several parts, right? You minimize the distance to point out. You might be the chancellor history or em the personal distance.

But here, we are supposed to be on our previous another paper as an efficient distance measure, how to measure the distance between 2 sets of points is a long period. Not true, probably. They saw the challenge, because there is no response. This is different from the image. It's different from the images. So you just calculate the difference. If you respond your picture right based on the coordinate. But at the time, probably there is no response. How do you measure the distance? How to measure this is also a challenge problem. The company in the ep or the emb or cd chamber distance or emb the action of this state with this. So that and also to give, but the above is not good. So here is the use of all of this is actually also bigger. This is an idea. So this is an idea. This is a self generation that was sort of self supervisor, because yeah, actually, there's no branches here. Because that intuitive simply you want to is that an apple, this is the input industry type out in the rack and the opposite image and you supervise this image with the branches in.

But here it wasn't a bunches and no branches in. This is a 70 ., except as well. The initial the input is an initial way. And the loss of drugs that one this is a the slides and the left. So for the system, actually, so this is a video. Maybe you think, I think I will introduce this. This is a distance measure, the distance measure. How do you measure that? But this is between two. Part two. Several parts is not true on treatments. So you can be interested in. So you can also do this paper. And so it's hard to define that this is natural here just to give you more. So very interesting ideas, but for others, like the private matter, just basically concept, just basic concern.

So I think for masters student is too intense recent programs, the state of art is that ok and let's continue the connections of the target match. Yeah. So the next one subdivision shows. So the sub the subdivision show is actually designed as most of as a negative sequence success requirement. The idea is a based on the procedure. So this is an issue. This is an initial model. You can observe it. You take the shock, actually, right? Sharp edges. We want to define this model, and we want to define this model is that part of the shop owners aggressive?

So finally, we are can suppose service for the subdivision services is used for you to generate the extremely small service.

So the small services required for someone that's an airport is not they have some the kind of the car. So we got the ship is a streamline. Right? Streamline. We can reduce the reduce the wind resistance. We need to design a smooth surface. The vehicle is on, that is not supposed surface. Here. I just showed this idea, what is the subdivision? I use the subdivision curve. So that if you will have a few happy experiences like business, if you want to join a circle, you have no additional truth. If you rather join a circle, how to join a server? Just we are right. Progress becomes a comment many times. Right? So you will ask in the up here as a proximity 71. So the idea is that let's say we love you given and we want to just what we want to produce a special here. That's this is the right kind of enterprise. A it's a blue part. And the blue part is the enterprise. How do you produce this small scale? So the name is on the part so that it will be progress, may have to come.

Ok how do you have a common message? So given the rectangle, so he sets the red part. The red part is located on the of this edge, except the two red parts. The ratio between the ratio a is a pretty one. The first reason this settlement and this settlement, a it's a pretty kind of we put on two red parts on each edge. We put on two red parts. Then we connect this than rather finance. And the conduct will be remote, right? We are in this shape and obtain a particle with more edge, obtain a particle with more edge. Then on each area is the green part here. The green party is stupid on the presentation on each edge.

And the next step is that we connect with us the green parts, then you are in this book ok so if you repeat this process of planning and doing anything is cheap, you will excuse them.

So this is aa hard partner how to produce a small curve. Okay? But we can extend this idea to service, but it's more chinese, it's real estate. You have to you have to consider the connectivity. How do you get the energy? How to change the geology? So here is this album that's a cast part of the division, the new subdivision, and the father presence of division. Should he give it someone? It is the capital parts of the ok actually, the initial is appeal, right? Given a cuba, the first time we can select some of they can put some the looser beer. We can put the blue, sophie, the blue sophia is the average. It is located on the center of each face. This is the next step. We can put some the magenta here. In there. They can put the magenta cube. The magenta cube is, it can be the average in the middle of each patch. Also, we can select people with the original text, but the queue is the original. There are eight practices with aa slightly more with the original, one protective to to produce the green cone, the green cone, then we will connect them, produce them in this one, progressively based on the predependent procedure.

So we obtain this impression, obtain this. If we repeat this process for each face, then we repeat this possible. So which ship will be part of the departments interview the heavy speed. The real purpose I have is still so this is the to yeah, actually the cops. And so it's a cut of the corner, cut the corner progression from this product, given the initial cube, we can produce a heavy spin chemistry. A this is subdivision ok next one is in this service. For the immediate services, define a seven final 7 billion procedure.

So first, if this service is defined by in this amount, in this function, in the last lecture, I asked what it is, the function, what it is, the function that in this function, actually, what is it? Is the function. This is a function. It's difficult to find that the analytical solution, ok the following fxy is the same. What is this basic? Is basically the equal to fx it can be shown that this is right. If that is given axis, why do not? Is that? Is it?

For this, one is keep going on in that. And the analytics would ask equal to one, going to the one. This is appreciate defined as a function, high order, highly nonlinear function. Higher than 20. So depended by the function, it is sharing. And by the function. For the increase, the function a is a difficult part in the exact value price, I see. But given our ., should you find exercising? We can check whether the client is repeated on the service or not. You can the function equal to zero. That means the part in the beginning of seven as well. Otherwise, it will be in the so this is an advantage.

But the disadvantages, if you want to generate a new type, this a a is division. Is china? Because we have another unusual solution that is given as a file. We don't really exactly the same question. And also, if you want to the modification, it's also not, but here I want to introduce the but it could increase the service. I want to introduce another ones. We call it a sign of this in the field. The scientist appeared is is to the kind of the three d models. Also, you do that. If you win the bigger impacts there, we can usually use a neural network. And then scientist first of the end and actually the definition is quite it's possible for us.

So that's what is the scientist confused. So first we have to find them is the sign that is a distance that can be positive or negative part of america. So the whole space is divided into to us that we consider. We consider a closed model or the water type model. Water type model that is the model is closed, which is the gender of the model, which is out, we can define the given prime as the scientist fears is defined. And that's a given this funny model, right? We have one finder located here. That's if I give the prime on the inside of the ship, the distance is positive. If the point is outside of the ship, the point, the distance is negative. That's given this point.

We can the distance is the . to the surface. You make it as a pilot in the surface. So give a .. We can calculate the decision to the surface here. This is a - people within the three d model. We have a part. We can define the distance is partly this is assigned assignment is assigned against the part, the distance that can be positive and negative. How to find the surface, which distance indicate so the so surface. If d is equal to zero, d equal to zero, we can extract themselves. It like this. One is a treaty space. This is the service.

If you sample a lot of People here, give you many query parts, so each part, the distance, there is a value. The distance is positive or negative. This side is all negative distance. This time is all positive. Here, the surface in between the location, the here the d equal to zero. It's educating the surface. This is just including space. It's really space for sale. We just indicate industry history. There. You can sample a lot of paradigm, give us price at no hope you should have a distance. Is it possible and active? If you industry space, you sample a lot of points. And based on the distance, you can we travel the service. This is also aa kind of aa representation. How do you can use the regular doing? It's a that is give us release in the three d space. We can generally directly in three d space. For each grade, you can improve the distance. We include the distance, the distance is as well. The greater price to the surface, the greater price to the surface.

And then in china bring on the distance, we can show how do you transfer the other? How do you try the surface? Can I do this for someone? You could say the mass of it is not watching cube. You feel you can search the marching field. And that's in the two d six ok this is a two d grade, so many grade, the tv space. And for each grade part, there is a distance. You mean, there is a distance. Here we become this one. Each will find indicated this is higher to resemble that. Here for the blue pine, that's in the blue pine that refers to the positive. And the red wine refers to the negative. We can check out for this line segment.

Both enterprise are positive. So that means this line is outside, right? And the service has no, we will not accept this satellite ok if we consider this one, this example, this line set of black, what on the planet is positive? What on the planet is negative? That means the service will intersect 9 seconds, right? So that is the service area. Cross is not that then we can exchange the new market, use an average. This couldn't pass as you read the second part.

If you check all nine segments, this is 97. And in the graph and the four edge of the graph, this is an intuitive space. The space of the test is that cube? Right? Is that cube? So you the massively the marching cube each other. So that means give us three d model. We can use this way to the end of the supermarket. You just generate that should be regularly for each new requirement to calculate the distance and the sort of distance in a way to find. If you want to be travel the same, it just processing. That's really good use. A bunch of cure or other methods.

Also for someone, if the prime is the top of me, you can also share that you can also set the stressful is a transmitted scl the tscl if this is the largest threshold, you have to accept them. We have said the value of the real plan is to what? If the business is smaller than a threshold, I will send it to. It's a very - 1. Actually, only the the points. The real price is the close to the side. I is it too far away? It's meaningless. So it's a trajectory asset. Is there for this kind of commission, given a lot of dependent, but what's the limitation? For example, this speaker, what's the limitation? If the grid is too sparse or the resolution, the resolution is not high enough, ok the resolution is not high enough. That is the fine to be killed. The geometry structure will be missing. I there is adp stock. A is a large block ok so I need a recommendation, actually see the judge refuse I the service, not fine enough.

But if you use a very effective, small, great, I the density, the breeders are pushing is very hot and you can shut the the things such. But the problem is the computational capacity will be very ok last year's treaty space. The greater resolution is, you can send the region. You see, you have the you can check the resolution. It's a 256 in the proper street ok so it's battery consuming. But if the resolution is designed, it can preserve the dictator strategy judge, but is a the doctrine was a time consuming average consumer.

So that's why so they I see post the deformal stf that is we also start, that means agreed it can be default. This is a revolutionary, right? This grade can be defined. That is we also didn't offset. This grade come over to the slightly moved. So then the offset, a distance on the offset. So it will be a large dimension, informal. So this way they can be informed when you get off that a so a this kind of role that is also because the data structure is revenue, right? You just thoughts you need revenue is 3 times should be revenue is awesome. Once we magic surface and parametric surface, here, firstly, you manage them the parametric curve. If the parametric curves is actually the parametric function and efficiency, here we can see the three dimensional curve, xyz ok each dimension is defined as a professional equation.

So here is a group of companies, and so here is only a single company. America is defined on you explanation to define that as a function of using why is also defined as a function of you? This is also here. If you change the value of you, we can trace a curve. If we can trace a curve, this is a I mentioned for, I imagine the service actually is a tensor product of the future. It's a program standard service with the two. It depends on product of two terms and service. So here I think so this is a promise yourself our national services, they found on two variables.

Then we found a few variables, each dimension, we found a few variables. Asmp we check the variable smp we are concerned is that this is the same, right? Severe. We can do a kind of union and how many is from itself? Each dimension. But probably the essence the s and t is an angle between them. The two, xn or xx x it's an angle.

I think for this one is new year. One last time, parametric education in 01 on the level. And lots of this is the to the format. We can do the matrix multiplication. Can you mention multiplication to the the curve? This is the magic curve here becomes zero. If you is the ambitious. Actually, a is a vector of the project. I don't surprise that you here, we consider cuba. I don't know if cuba are metric polynomial, that is a the variable. This is the problem, the first or the second or the third or the. This is a huge an argument. M is aap in the control part. Ap is a 72 part. In the given the part we want to join from classroom points. The peter people find.

So m a the m is a issues of 4 times for quite a basis issues, is defined efficient value in terms entirely back to the region for each country. You should hear your example, let's say we run into a curve, but this is in qd space. This is the key space that here, the control pi is a four, control pi is from p zero, p one, p two, p three, and 4 . 1. And given the patients, the patients is this issue 4 times 4 to ensure you to the higher cost into the type of the problem.

And you is the biology. This is also a cubic interpolation, the cubic in the position, but nothing. This is a matrix of you, the higher this curve. This is the explanation. This is the violation. This is my, so here is you can show the problem. So that is the former couple pass through the former trip. This is a way to use a vicious modification. Also for the time actual service, how much is something actually is a concept? It's not as a product one, and you can pay this one and serve products. It isn't that as the Four elements. So of it is a 4 × 4. Right? The two vectors that we can spend on interest. This is the parametric service. Actually, this is the s matrix, the key matrix is the response is the three other part, one ok three, other common model, s and p and the p is a . 4 times for 16 to 2 ..

Ok here is this is in the 16 and 2 months. So every is the the basis measures. And how is the basis? So actually, you have this one and the the forecast for you. And it is as a product, two vectors. This one, you take, this one. It's a similar to the p time as a transpose. It not depends on p transpose. This one, this is a vector, this is a vector, ph if you and aa lot better transpose. So if you feel a part of it as a prove that it will be a matrix for transport respond to the control part. The response is a control part is a tensor product. Surface is a the supposed information to do that, just modify the control part.

Actually another discounted. The product is so easy to render. So what is there? Any of this is expensive to renders? We only give you one object excise. You. You have the capturing for each xi you have to do a function, even as a computer function, the equation it will generalize. The change will be done for each combination. In computer solution, it is probably the value. So this is aa happy service for comment.

And then the next one is, how do you go? I think so. The works of recommendation is simply compound similar to the picture. Future is including wage. Picture is apdk for lots of the kind of maybe on it to choose this. For example, if you run with aa cinema as a similar and you can watch it here is cuba itself. It's clearly about yourself. So we can even call it out. We can improve the unit one. Why is you inside of the city? Zero indicate the outside. So to the end of the city, it's like the binary unit, one, binary unit is zero, and 10, and one. It's a binary image. Also, you can send us atv maybe that's three images.

So great images, for example, individual image is, is it from 0 to 255? Also, we can use npap is a watch for each boxer and 80 the value. That is a value from zero. You need the questions kind of you need the emissions, right? It's like a reunion. If we use only 0 or 1, it's a battery image similar to the battery image. If we use a bad value, if it values the similar people, green image and similar. And so this is the works of is actually the extension work, patient human to three states, but I watch the renders objects. But as a swap agency, you want to skate on information because of these three cells. But if you want to skill the object and if you want to be open, be found also in 19, also in the request for manager, you start watching. So for the one, so if you use that, you process the . of it, you can do the virtual addition. That is the in parts of the three spacing to the queue.

The cells, If a multiple points is the multiple points are distributed in a and then they compute, we will use the center of the field is advanced. So that's it. I I used to be. So let's see in the space there soon is that many blocks? So we can put it into the, so that's each block. Is it referred to the blocks? Right? So here, the message is this from a bottle points are located distributed in this problem. We can do the box organization, and we will use the same time. The center of this bar to the end of this.

Here, for example, there's 3 points on the tv in this bar. If you're going to use this center to educate, this is 3 point. This is what I mentioned. And also, it can be short of the quantization. It can be short of the quantization of the wrongly, the wrong obligation. Right? Even if you, for example, is 02 . 4. Right? If you probably the right one, I there is no on the two left. So that's this one. What should I issue to process? The point of point to reduce the number of points? For this worksheet requires a memory that is how to start, what should be, how to start, what should be that. So he is that we have to see what happened. We can a use the object. We can use an op trader ok the option is to do the tree structure. Ok we have part of the street space to the parts of the city space to the substitute several regions. The separation.

For example, if this is the first step, this is a person in the room, and we partial the the last region is a sub regions. It is sub regions, for example, before for this region, all options are zero. You will not come from subdivision. It is a single, just use this node. No, continue, no further subdivision division ok so if the sub regions, in case, zero or one, and we will provide a division here, ok until the that in the sub region is all zero.

The information will be started in details, but your commission will be started in the regional. We can learn all. Trade presentation is an efficient data structure for function. That, for example, this node is responding to this region that is all in this region, all boxes, the value equal to zero. You will not from division. So this is the option. The next one is the structures strategy assignment. You actually, it seems to you someone you find someone pulling up return in defense of pulling up later to combine some creatives. If you can give us a single object, we are able to emerge to control the three d model is coming. It's much. Let's say the only operation, three operations, this one is union, the union. The worst option you want.

The union operators emerged into one. And this one is the difference. The difference is a minus t there's subtraction subtracted again from the other one, is sub subscriber. One of the other one here is one subscribers of the severe from the cure that is resolved this over that range. And the third one is the intersection. Intersection is the collateral, is the whole of that. It connects the partial properties. Both options is a partner, probably both objects. And so this is three women are patients, and this is a 3 point option. This example that's a given the primitives, the primitives is the cylinder, the cube, and the speed, the similar, the q and so this one, the primitives, the q is severe, the same.

Here we want you to follow this line. You want to construct this line for this side. This side is the first review. The first is to this one. The common is to find the common part, right? To find the common part and real the ship, this match this side, the right side. The worst, is it right? We combine the city and you are object and this one combine if you are anyone as we are in. At this level, we perform the difference such as this the right side from the right object. I can try outside the knowledge. It was a limitation. We suggest that based on this procedure is the massive question.

For example, if I want to modify it, if I want to . back on how to be evaluated, we evaluate all the steps, very short from the lawyer to do that. Made instruction in statistical. This is the limitation. If there is an object, you have to all the patient in the csg true need to be divided, re divided. I remember 2 years ago, 71 papers, but he csg he is living as a construction some. Yeah, so if you read from you, if you feel fine as a man is everything, he is following from the rema from the traditional message, just the written message. Usually, why do you use learning or for some traditional method? There is some in paragraph revenues, right? A is a matter of the specific and in kind of but we can use the linear asset. There is a problem from the data. It will be adapted ok send the parameter just do that. Based on your entirely settled on it just in the experience which government which comment then how to send it to time and just give it away skills.

But if we can use a living method a gap year, right? There is a part of that it is real bad. A use of a traditional knowledge. You construct the learning method instead of designing the learning method, purely in the regression gsu the branches, the supervisor. It's a security regression. The efficiency would be very. No, ii also promise you anything if you incorporate itself, transitional partners, if we want.

So that what will be american? The network of the efficiency will be very much promise. Possibly is that seven and that one use only a limit, only a number of travelers to achieve good, possibly some a lot of ways that many ways that is a lot of people. This is the same. We still have a the last revolution, the last one, the fact that actually, this is it from mathematics that this is a crack option. You refer to those are the 7 second. All of you can you suggest the object is need the yes. So this is the degenerate, this slowly degenerate. They don't mention how about others, seven city and different resolution here. So is the tree structure. And also that's supposed to be on. The coastline also reach struggles practice. And so naturally, so this is a on the tree shots. The trees shut up and leave the avenue back.

So how do we find a variable? It can be recursive, applying the same transformation function or even function here after the international is here on the object. So that's it. Give a triangle. So give a triangle. The transformation is this transformation. Just a lot about each act. Just talk about each other. If we apply this transformation to the three ashes of the limit triangle operation, you are in this ship, right? It's not sure, right? We have presents from this idea. Transformation function is that if you modify each section, each idea is special apply this transformation, which we will produce the yeah, so this is a master for producing this.

So a a this is someone examples. There's some examples. If you only you will find the structure is still seven seven. Is there junior dials? And so we have the final decision for this one is a given this object. And this is the option, the transformation. It will be present at this function, whether we go on. This is a massive. It is true. Apply this function because we have also the colleagues, an example. So for three d it was maybe a it's a for example, or you can generally amount that's a given the kind of the modification, the transformation function is a certain dimension, a certain issue. We thought my parents, the former pyramid.

So let's say this is the first transformation, the first that general purpose it will be. The next step is, instead of at the commission, again, for each case, the third commission. So that is transform each phase as a term. This is a it could be the real produce among that option. It will produce among that option. Also, if you want to do makes a and generated the produce, the object looks more natural, looks about actions. You can say that between them in certain part, which is certain part, they take a slightly change this time. It is the third part is that the picture of the issue aaa standard here, we generally is one, actually for this section, right? You show is different. There is a complication for the requirements of the concept, the concept, the each level. This is final.

Here I want to introduce the first section, especially in the beginning of single complications from which are very important, which which the representation is used. It depends on the application. If you remember, this representation is in terms, also the downstream average. It's awesome. Because when you design to have it, take the data structure, do you want to study law? But excuse, but that also generation we can just generally the last one, but as the device of revenue should be great, in fact. So you can give you a lot of generally relevantly. We try the service, you strategy the models down.

There is an earlier study next week, not ask me to serve action. And that is an election. It's probably part of next one is about yeah, I don't actually accept the cost project here is worth it. Takes up the part of the time different parts. And that's the education we are more three blocks you can that as well as is next, bbc may not be you are nigger. You should have erer if you have now on sunshine it is on it is I such as your usual in party of the city and the operation is actually about us. The big following meet up we talk is c but even if you write special work, how do you? Let me guess just to take it. Nana. My god. A.