### CG\_week5\_lec2Transformation-20240930

说话人1 00:17  
Ok now, let's continue the lecture to finish the video part 2 points. So here we have a use the matrix modification, but we introduce the homogeneous aside, directed the homogeneous particle is in chinese. Chi is for your I just make a mistake that the we use a genius part of the unified, different kinds of transformation is a farmer, which is an application.

The next part is the higher proper universe transformation. That if you that give him a begin a gracious app, so we will apply to transform applies from p to p prime. How can we undo the transportation? So that will be our p from p prime and recover p from p five for this one. Actually a it's a linear equation as a little increasing. If you want to the p prime and p is unknown, you just saw the equation. The equation is the equality qualified, the universe, which is at right, the universal issues at.

So you will teacher, if you multiply the universe at the universe at the universe and is equal to identical in this graph, iii identity, which is, so you are apo two ok so the next the key problem is how to compute the universities and how do you compute the universe? The computer universe is not true. It's not true enough, right? Game of interest. You have to learn some ambassador to compute the universe, right? Forgive a general issues given generation, compute inverse. Yeah, I think it's an untrue ok but here for this class, we we learned the translation and the location and the scaling and the ship right here for the because the nation is participation.

Ok so their importance is also transportation. You just seeking your intuitive manner. So for example, the translation, the translation, you translate as an object with a distance, with the distance, the typical data, how to recover you? Just nagging the translation is, right? You just negative, and you might, as translation is right. Here's the issue is this is a transition is the universe is just a negative, just negative translation business, right? Just negative translation business. If you compute the t the product, this commission, you could identity patients, right? So this is a translation. The universe of the location issues. Ok the universe is a you rotate a with an angle, you rotate with the actual system. To recover. You just rotated in the opposite direction, right? Just negative is a negative rotation angle. Just negative rotation angle. You just negative is a the location angle, right? Is it also for the location matrix? Is it equivalent to taking the transpose orientation measures?

This is the original location mission. If you negative, the chance the rotation angle is due, it's a use the negative minus theta minus theta cosine minus sigma is equal to one cosine theta one. This one, you will obtain, if you use a nag, you if you nag is the same as the cosine, I can see the equal to cosine. Sine like to see that even. So this is a actually, this one, the universe, if you transpose to this group as the first part of the second and the second part, the circle and the third column, you will find this the inverse equal to the transpose, that the inverse equal to the transpose.

Under this case, a our mission is, it's an orthogonation you have in the transpose equal to either in the universe. Right? The rotation matrix a is a solid matrix. Ok the condition efficiency is on subsidies. So also for the skating, right? Yeah, you're scaling your body power skill factor, right? So you just replace the skill kind of, is there just a problem, right? Let's say this is a this is a scaling racial device, the universe a it's a just replace the scaling factor. It is with their reciprocal, right? If you compute the multiplication of these equations, if you are in the spirits identity matrix, right? Also, for the sharing, it's just negative sharing factor, right? It's just negative sharing factor.

Let's say this is actually, the universe is a discovery that should be better, I guess. And for this matrix inverse, the reverse transformation is because the division is required preservation. You can obtain the inverse of this vectors easily. You just seek you treating that. Do you recruiting? And so it's crazy thought in the universe. But for general, patients, generally, if you run out in the universe, you have to use asset, right? But he would be the key competition asset. So the next the next time is the next page is about the is the order so that, let's see, I so here I would like to ask one question. If you are required to apply, for example, a series of transformation, that's a two or three transformation to the object.

So you may apply the first one, the second one, the third one, right? At the initiative already, 45 people, given aaa five private. Let's say this is the transformation, f one, f two, and f three. Right? So after the transformation in the p you find right here, can I exceed the model? This is the number one and two, and three.

It's 3 kind of transformation. Here, can I exchange a lot of, for example, iim two, first, number one, second, m 37. Can I exchange about, in general, and exchange of order? So that's it. The p prime could do a lot. In general, I exchange the order. How can I each other? In general, you kind of exchange the order. If you change this result, what's the fundamental reason? What's the fundamental reason? That's a given to matrix value, computers of matrix modification? A it's a if you change, which is ab time, which is a can we change for scalar ab equal to ba right? If a and b are two scalar, you can change. But for this one, in generally, you kind of change, because matrix motivation is another complicated given are defined. Matrix modification is not ok it's a different from a scalar in. Chinese is a jiao kuan bi.

You can't achieve the the order. In general, it's a you get that .. So this is the fundamental reasons if you apply a series of transformation. Right? In general, you can't change the order if you change the apply the transformation in different orders. So that means this result will be different, and the final result will be different. This is a fundamental reason. This case is true, because this is modification is not communicate with each other. So you kind of choose all of them. Yes, thanks. But for some special cases, right? So you can achieve the other. Like if you want to apply the 2 kinds of transformations, but to both transformation of translation, I transmit it for us with a distance and translator, with another business a that is a for example, for the translation, t one, and given five, t one on the tv that I exchange the model, apply the translation tq first, and the tt one, the final result will be the same different for transportation.

It's the same, right? For this. The special case, you just transmit the t one is a total transmission distance, and even you change, let's say this is the t one. This is if you, even though you change on the total translation system will not change, is still keep one positive, right? This is a special case in connection or in general country.

Here is this example, let's say in a part, we we can't confirm the skill first, scaling operation first, scaling first, the translation second. This is a skill that and the translation. You are here. This is the result. The product is in case, but if I change the order, so, sorry, translation first in skill ok translate first the team and skill segment. So here you are. Here. This is a product of this commission, this one. So that's different. The final result will be different. The final result will be different. In practice, if you change the order. So the final result could be alone. If you did that, if you didn't follow the original order, the final result may be different. This is the this is the order of transformations that doesn't matter all the time.

This is aqd qd translation. Aside the qd transformation. The next part is about the three d three d transformation. But for the three d transformation itself, it's a lot for the transmission and scaling. It is a 34 expansion. Ok it's a straight product extension. Ok just add one occasion, xyz ok just as evolution. But for the rotation, ok for the rotation, it's a compared to the studio location. The studio location is much more complicated. I the general should be rotation. The general should be rotation is much more complicated for the transmission and the skills. A it's a similar people, just a straightforward attention. It's still be away for 3 × 3 spaces. We still use. The, it is a homogeneous partner. You just add one more division, increase from three condition to four division. It just add one more division, add more money.

So then we can for the three d transportation, for three d translation, just to translate it all in a three d space ok here we have one voltage, right? The same division, ok so it's a straight fire expansion plan straight by the system to be translation.

Okay, also, with the homogeneous parliament, with the homogeneous parliament, we can write about the equation into the missions from, right? You put the translation system in the last column in the last part. So we can ask you the the translation nation they controlled by three. The translation is along the three dimensions, three directions. Yeah, also for the scaling, right? Similar to the chilly scaling, they are scaling around the origin, skating around the arbitrary part, right? Skimming around the arbitrary part. For the scaling relative to the origin. Yeah, this is similar to the two d skating. Resins are if I we do not artificial as acd nation, that probably is 11 dimension, just scale, the multiplies of scale factor in each dimension, the multiplying each the spinning pattern in each dimension. They just scared time. So here is the is that they are equal. So it's a uniform. So also we have innovations from, right? We have innovations from, but for the given the reference part, if the rep reference time are not, only, it's a hydrogen part, and the rubber climate is actually fine.

So how do you handle this case? How do you handle this case? If the scaling part is not the origin, you can still use the streets, actually, right? You can use the three statue, right? So this is the three statue given apart, right? Give us part p first. We translated the translate is a the scaling, the object, it translates the object. The fixed time is going to the origin and then skilled out around the orange and onto the train station and onto the train station.

So this is a single pd cigarette pd compound. The single pd compound for the three d rotation is the three d rotation is quite different. Also, we have one more dimension, but its more, much, more complicated if you want, in general, to the education. Here's three d rotation. We use the act axis on the rotation model. Ok the three d rotation could be defined by rotation angle and the rotation axis, rotation angle, and the rotation axis.

The rotation axis is defined by two parts. It's defined by two parts. Okp one and p two is a line pass, a line passing through. The 2 points is a defined rotation axis, ok and the rotation is allocated around the patient axis. Ok this is the general specification. So the object will take around this rather dash line. Ok this is the rotation axis, defined by two parts, p one and p two. This is a feature handle in contact. Otherwise, by the end of the city, this is the general. But if you want to obtain the we can translate this location axis such that this line passes through the origin, right? You just to translate the technical distance. So this line will, the red dash line will pass. We'll pass through the origin, and we'll pass through the origin. So this one, so we had to consider this one. So after this is also the three statue. If the line in the past, if the line is the location accident passes through the origin, and to obtain the rotation patients, a a it's a somewhat simple after the location translate onto the translation, the population.

But so here I chose a i'm sure, is about not introduction of details. So this is a a we can consider this model ok so on the rotation axis is passing through the origin. This is a normal vector, a a unified unit vector. Ok you need to better indicated the direction. Ok you take the direction of the city of rotation. And here, this is the process of in the insufficient. It actually is some simple geometry. It's a simple geometry. But you can read this. We will not even use the I just do this is the location issues. Compare the qe rotation is much more complicated class, but actually, it is still not the gentleman. This is the rotation axis that passes the rotation axis, passes through the origin.

If the general is an answer, you have to output the transmission, a private translation in addison. So this is a the channel you can refer to it. I have provided the how to obtain distribution step by step. For this point, some of the simple geometry ok some simple geometry progress, just this one is you are not required to memorize these issues. But what I want to show you is that is the senior rotation. It's much more complicated. Yeah, much more complicated. But for this cost, we just learn the switch station is in three special cases, it a is a location around the target axis, the rotation around the target axis. That is, for example, the rotation around the z particle x the other location around the x other location along the line. Three special cases, the rotation around the targeted axis. It actually is a it's a almost this the same as apd rotation.

If if you rotate around the z axis, that is the emission, keep on training, right? If you rotate the object around this axis, the division is always, it will not change, but it is this will be the action also in history space is boiled down to the occasion. Ok he said he could be located in the acts like that. It just pulled the rotation off, put the two d rotation out of the x packet, add one more dimension, add the same dimension for the xy rotation in the treaty plan, out of the treaty plan, add one more condition.

Similar for the explanation, you is equivalent to the patient in the violation should be planned just to provide the location of violence and outcomes of that.

Yeah. That is a big explanation similar to the explanation location around the my condition. So here give you. So the first one is that's a location around location around x axis, rotation around x axis, this one. That is the x condition. As part of it. Keep on changing. Ok it's equivalent to rotation in a bicycle. You said you couldn't do the patient arising and from applying position. And so we can build the patient refuse by saying that. So this is a relationship, right? How the rotation and we come out in the rotate around the exhibition. Here is not absolutely based on treaty. This element is only one. If you multiply a vector, xyz one, excavation came out here.

If you only consider this part, this part is 3 times 3 sub. It is actually the rotation by zip back just these equivalent, adding one more role and one more particular exhibition. Yes. This is a rotation around x similar for the rotation around the bottom. Ok quotation around the five axis. So that is the right part of it. Ok five particle is on tree. This comes so this item is what you have a lot of appearance of these issues. So the time of iron is one and the second rule and the second column, the evidence consumer.

If you remember this rule and this color, just keep a this one. So you see equivalent to the location of the from the usk the last one is the location around the z rotation around z z division can launch, right? Z division can launch. And you see incredible rotation again. X vitamin from x one.

This is a three spatial cases. The swiss figure is their location around the body of the axis. Yeah, so here that's it. For this kind of question, let's say, give a five. So we can see the swaps on or question. So that's saying, even so this is given aa part of it. So we can define the so this is the, it's not realistic. This part is as zero. What? Okay? Another part a is a two, 11. This part here, this align the rotation axis, passing through this. This is 2 points. This is 11. This is the 011. How to obtain the like gene appliance is a the pioneer rotate around this axis. The axis is defined by these 2 points, the 011, and 211.

How about in the part of the location? We keep around this line. This line is industry space. It's not the general, it's still as spatial rotation, not a gentleman here, this line, the parallel to parallel. If you ask around the product x you have translated you as for us, right? You do the translation, right? Do the translation natural? Take our eyes. And after the translation, this question we are in previous examination.

Some students are behold, this is a general location. Advertise is not a general location. It's still a special cases. Right? The rotation axis is the power. That is the part of the axis. The general is the rotation axis in the three d space, a not a parallel to any carbon axis. This is a challenge. Ok this is a student special case. The location axis is not as a part of the axis, but it's powerful. This is a cd location, okcd location. But for the job of cd location, it's not required. And also for the studio nation, an arbitrary rotation around the origin can be composed three successful occasion around the finding an axis ok also for the studio rotation. It's not a complicated. It's not a complicated. If you change the order, the final result will be will be different. And the final results will be different. But on the trivial issue, you can achieve it, makes it a sense. Is that the photo is that because the photo of a vision angle in the same way, for three d take it to the other, the time is probably different.

We still have a 601 page, the last page a it's a concatenation of nations, let's say, in practice, in practice, you want to apply a serious transformation to a model three d models.

That's a three d three d model a it's a triangle match, it's a triangle map. We can. That is, if you want to transform the object, right? If you want to transform the object, you have to transform each part, right? Each attacks all the kind of a series of transformation to the attacks right here in this example, that's you want to apply and transformations to the ., right? To the transformation of the party practice.

In fact, that we do not acquire the transformation one by one to the, which is to the point ok before applying the time we first compute the product of this this matrix. In china provision, we should be up here. And overall, the overall transformation is a panel. Is that multiply m to p what's the advantage? Instead of talking kind of which is 1 mile, the transformation to 1 by 1 p we compute this, the product of this ambitious, and then we apply the p why do you conduct the application? What's the advantage?

As I mentioned earlier, if you want to then this is true at p sorry, p point, not to one part, a single one apply. A nation's transformation is to give one. If you without compensation, you apply the transformation, one by one to each point, you have to apply p times n right? But if you apply the, you compute the overall transformation visions, the multiplier is actually the complexity of k possible. This is the one you can see the competition cost. That's it. In graph is given is a swimming model. Does it a three d models into one side of mine? You want to apply 100 transformation to each part? So simply, you just apply to follow around to that one. So 100 transformations, ok and what? Sort of points? Just a few groups, right? But the capacity is × 100. But if you compute the compute the overall information issues, right? Then you'll have one someone is when someone passed 100, when you said about some times. So it would be a civic competition cost, the civic competition cost.

Yeah. I there is all about transformation for this part. This is probably the final exhibitions are part of the time two or three parts about it. They have to give this examples about. Yeah, so after this is the one question. The previously, the final operation since the last one.

So another type of question is give up vicious. It's a product, two transformations.

So you are required to it's a compilation information. So you have to come for are you have to be composed to, basically, that's it. And I have it all. This is a translation, i'm sorry, a typical location on the scale. But I tell you the fact is about you are required to be composed which kind of true transformations is continuing these issues. It's based on your understanding about the appearance of the nations that if the appearance, other issues, it's not difficult option. He composed these two.

To the case it just not difficult, just single action. Yeah, I think for this part is it should not be thinking about because all you have been in the meeting. If you have many have people, so you see income, but for undergraduates, for the online value of this kind of credit, because the student is somewhat similar, have never known as the meeting have to go. So I have to to explain the issues of competition from the beginning to expand what is the matrix and what is the issues of. I have a question. They will finish. I have a question. Today, a we have a and three d object. Good morning.