

Artificial Intelligence-Assisted Workflow for Creating Interactive 3D Models for Veterinary Anatomy Education

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ABSTRACT

There is a limited scope for Veterinary students and researchers to learn Veterinary anatomy with 3D visualization to understand complex anatomical structures. In this research article, we have described the process of how to create 3D anatomical structures related to Veterinary anatomy using artificial intelligence and open-source software. Here, we have taken the course and distribution of the sciatic nerve in the ox as an example to demonstrate the process. After that, we recorded a video of this model and uploaded it to YouTube to record the responses of students and researchers. Based on comments and feedback from YouTube, it was noted that this 3D model is highly useful. We have also uploaded the 3D model to 3D model hosting platforms like Sketch-fab for easy and free access to models. This article clearly demonstrates that in this era of AI, we can use it for better learning and understanding of Veterinary anatomy.

Keywords: Artificial Intelligence, 3D Anatomical Models, Veterinary Anatomy, 3D Visualization.

1. Introduction

Veterinary students face a lot of difficulties in understanding complex anatomical structures due to a lack of resources. Every time, they cannot study by dissection of animals, due to limited availability of cadavers and ethical

considerations {1, 2}. Textbook images and diagrams are not sufficient for proper visualization of complex anatomical structures {3}. Veterinary students have very little scope for interactive learning of complex anatomical structures {4}. Nowadays, due to the evolution of AI and new digital technologies, this problem of learning anatomy can be solved. By using various AI tools and open-source software, we can create interactive 3D anatomical models, so that teaching and learning anatomy becomes very easy and interesting. By using these anatomical 3D models while teaching, we can increase student engagement, proper 3D visualization, understanding, and give them a scope for independent learning {5, 6}. This article demonstrates how various AI tools and open-source software can be used to make interactive 3D anatomical models by taking the example of the course and distribution of the sciatic nerve in cattle.

2. Materials and Methods

2.1 Study Design

The experimental design was a methodological study, which mainly focused on an AI-assisted workflow to create a 3D anatomical model for teaching and learning veterinary anatomy. In this experimental design, a 3D anatomical model was developed showing the course and distribution of the sciatic nerve in a bovine as an example.

2.2 Data Sources and Anatomical References

Detailed information regarding the anatomical structures, branches, course, and distribution of the sciatic nerve of the bovine was collected from standard veterinary anatomy books, atlases, and dissection photographs {7, 8, and 9}. Based on the collected information, a 3D anatomical model was constructed.

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2.3 AI Tools Utilized and 3D Model Construction

In this workflow, ChatGPT (OpenAI, USA), Python programming, and Blender (open-source software) were used to create 3D interactive models of the sciatic nerve in bovines {10}. We can manually construct the whole model by using the Blender software only, but it will take a lot of time. With the assistance of open-source AI like ChatGPT and Python scripts, we can create the model quickly with great results {27, 28}.

The detailed workflow is described as follows:

Step-1 (Base Mesh Preparation- Hind limb bones and muscles)

ChatGPT was given various prompts to generate Python scripts for creating base elements like bones and muscles of the hind limbs {29}. These Python scripts were run in Blender software to generate basic models for constructing the bones and muscles of the hind limbs. These bones and muscles were manually edited in Blender by using its built-in tools and techniques for accurately constructing and assembling the bones and muscles of the hind limbs. The above workflow is described below by taking the example of 3D modelling of the femur bone.

ChatGPT was given a prompt to generate a Python script (Figure1) for developing the base model of the femur. When the Python script was used in Blender, a base model of the femur (Figure2) was generated. The base model was edited manually for anatomical accuracy, and a final bone model (Figure3) was created. Likewise, all the bone components and muscles were created and assembled together to create the final base model of the hind limb (Figure4).

```

2 import bmesh
3 from mathutils import Vector
4
5 # Delete default objects
6 bpy.ops.object.select_all(action='SELECT')
7 bpy.ops.object.delete(use_global=False)
8
9 # Create shaft of femur (long cylinder)
10 bpy.ops.mesh.primitive.cylinder.add(
11     radius=0.12, depth=1.2, location=(0, 0, 0))
12 shaft = bpy.context.object
13 shaft.name = "Femur_Shaft"
14
15 # Add head of femur (ball joint at proximal end)
16 bpy.ops.mesh.primitive.uv_sphere.add(
17     radius=0.18, location=(0, 0, 0.6))
18 head = bpy.context.object
19 head.name = "Femur_Head"
20
21 # Add greater trochanter (lateral projection)
22 bpy.ops.mesh.primitive.uv_sphere.add(
23     radius=0.12, location=(0.25, 0, 0.55))
24 trochanter = bpy.context.object
25 trochanter.name = "Greater_Trochanter"
26
27 # Add distal condyles (two spheres)
28 bpy.ops.mesh.primitive.uv_sphere.add(
29     radius=0.15, location=(0.15, 0, -0.6))
30 condyle_medial = bpy.context.object
31 condyle_medial.name = "Medial_Condyle"
32
33 bpy.ops.mesh.primitive.uv_sphere.add(
34     radius=0.15, location=(-0.15, 0, -0.6))
35 condyle_lateral = bpy.context.object
36 condyle_lateral.name = "Lateral_Condyle"
37
38 # Join all parts into one mesh
39 bpy.ops.object.select_all(action='DESELECT')
40 for obj in [shaft, head, trochanter, condyle_medial, condyle_lateral]:
41     obj.select_set(True)
42 bpy.context.view_layer.objects.active = shaft
43 bpy.ops.object.join()
44
45 # Smooth shading
46 bpy.ops.object.shade_smooth()
47
48 # Add Subdivision modifier for smoother shape
49 bpy.ops.object.modifier_add(type='SUBSURF')
50 bpy.context.object.modifiers["Subdivision"].levels = 2
51
52 print("Cow femur base model created!")

```

Figure 1. ChatGPT generated Python script



Figure 2. Base model of femur in Blender generated by Python script

Step – 2

Sciatic Nerve Tracing: Branches of the sciatic nerve were made by adding path curves in Blender. The branches were extruded to show their detailed course and innervations.

Step – 3

Branching and Distribution: The major branches (tibial and common peroneal nerves) were reconstructed carefully and placed relative to their anatomical bony landmarks.

Step – 4

Model Optimization: Meshes were carefully simplified and cleaned to allow smooth functioning on web-based platforms like Sketchfab, Turbo Squid, etc.

2.4 Interactive Model Deployment

After the final model creation (Figure 5), it was exported from Blender in GLTF format and uploaded to a website called Sketchfab. Sketchfab is an online platform for publishing 3D models.

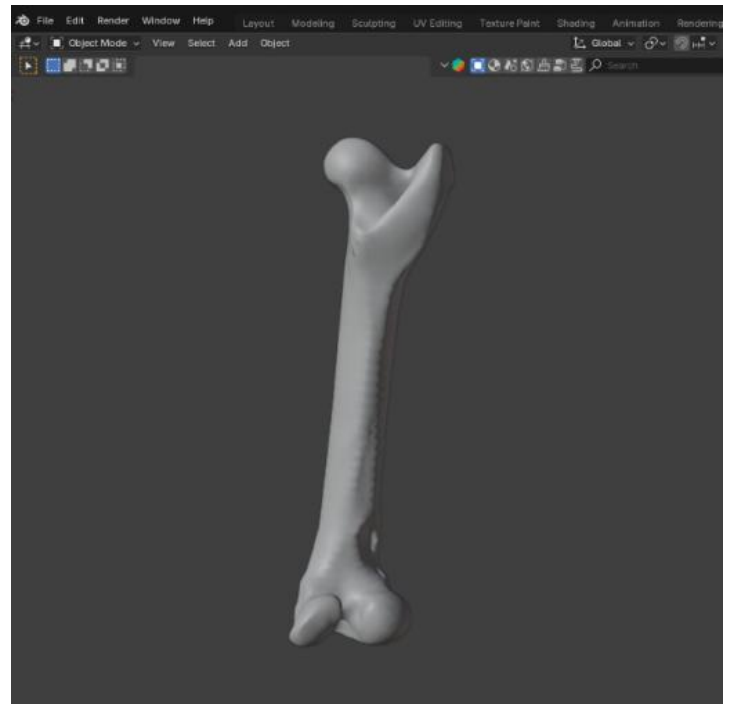


Figure 3. Final Femur Model after editing

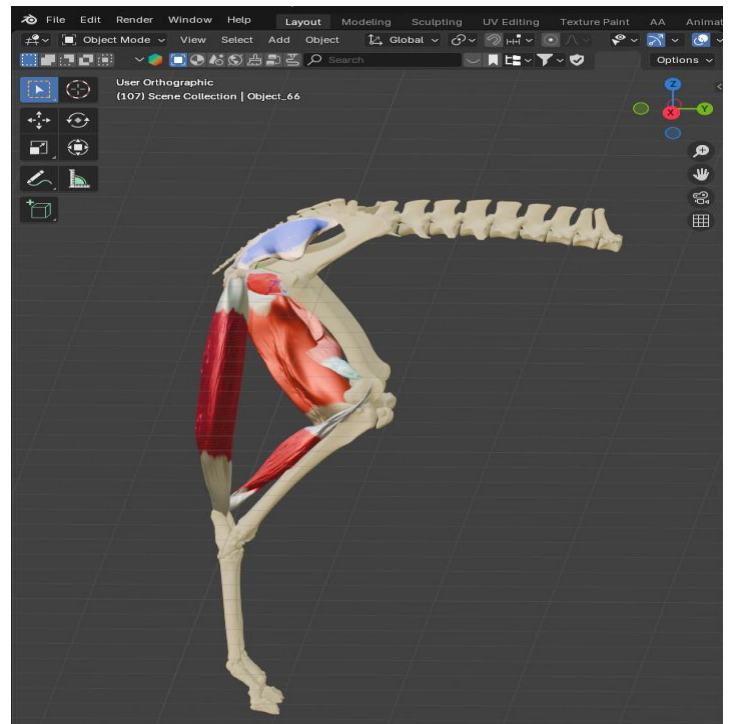


Figure 4. Final base model of Hind limb

Viewers can visit the Sketchfab website and interact with the 3D models. The models can be rotated, zoomed in, and zoomed out. Viewers can also navigate and study the details of the model by clicking the annotation numbers. Our sciatic nerve model can be accessed by clicking the following website link.

Model link - <https://skfb.ly/pAtAn>

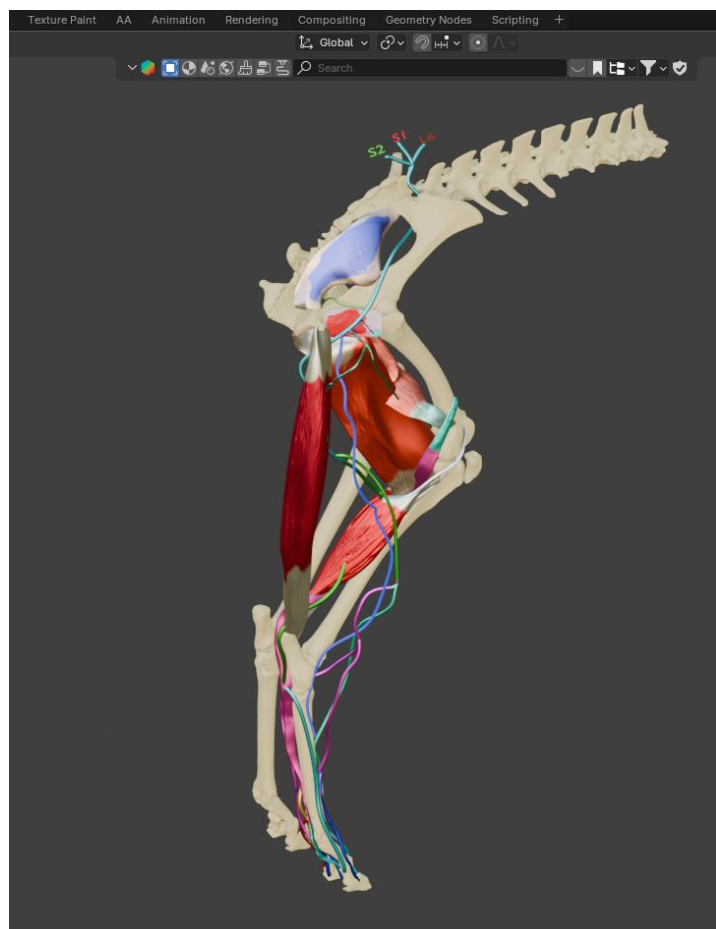
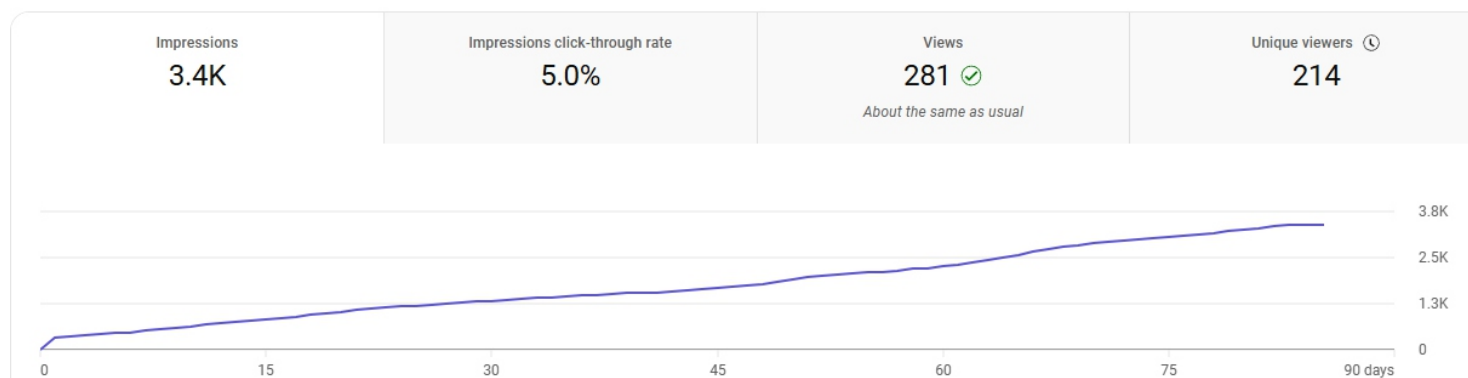


Figure 5. Final 3D Model of Sciatic Nerve

Table1: Thematic Analysis of Viewer Feedback on YouTube Video

Theme	Representative Comments	Interpretation
Requests for Specific Topics	- "Internal iliac artery" (@shereenabeeumr746) - "Sir please make video on brachial artery and brachial plexus" (@SonyKumari-iw3tu) - "Sir pls make a video on brachial plexus" (@KShankar-zx7pp)	Viewers are highly interested in learning about detailed anatomical structures, especially arteries and nerve plexuses. Indicates demand for topic expansion.
Need for More Resources	- "More videos we don't have more resources for veterinary, pls make such videos it will be helpful for many" (@Mouna_2908)	There is a clear gap in veterinary anatomical learning resources. Students find such videos useful to bridge this gap.
Encouragement & Motivation	- "Keep going. Please share more videos" (@SonyKumari-iw3tu)	Viewers appreciate the initiative and encourage continued production of similar educational content.
Positive Engagement	- Multiple likes on comments and replies (👍, ❤️, 😊)	Indicates student engagement and willingness to interact with the creator for guidance and learning.

Graph showing reach of the video



2.5 Video Demonstration and Distribution

The above 3D model was used to record an explanatory video, demonstrating details of the sciatic nerve in bovines by using screen recording software like OBS (Open Broadcaster Software). The video explains the various aspects of the sciatic nerve in ox, such as its origin, course, branches, and innervations. The video was then uploaded to a YouTube channel, with the following title and link.

Title of video - 🦋🦋 3D EXPLANATION of Sciatic Nerve in OX!

🦋🦋 | Course, Branches & Innervation Made Easy! 🦋🦋

Link of video -

<https://youtu.be/IKEYTTv9iVY?si=RgFY1pXdw5EmJUNl>

Students' and viewers' responses were collected and recorded from the likes, comments, and views of the video.

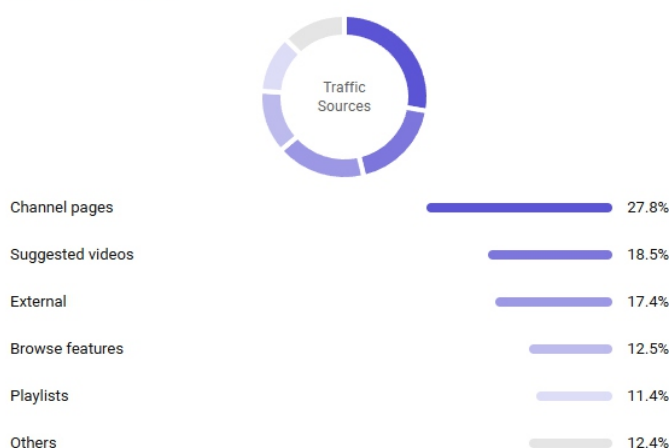
3. Results

The video was successfully uploaded to the YouTube channel on 23 June 2025.

The link of the channel is www.youtube.com/@VetsNotes. The channel was created on 30 Jan 2025, so it is a newly created channel with a subscriber count of 792 to date (16-09-25). From the date of publication till now (16-09-25), the video has 26 likes and 0 dislikes. The video has received many positive comments in its comment section, which can be easily seen online on YouTube by clicking the video link and going to its comment box section. The feedback is highly positive and motivating (Table1) to create more such anatomical models and videos in the near future.

How viewers find this video

Views · Since published

**4. Discussion**

In the field of veterinary teaching and learning, there is an increasing demand for interactive 3D digital anatomy models and resources{11, 12}. Traditional methods, like dissection of cadavers and textbook-based explanations, are essential but are limited due to their lack of availability, ethical concerns, and restricted accessibility{13, 14, 19}.

Many commercial companies have developed advanced 3D anatomical applications and software, but these are very costly{15}. A normal undergraduate student cannot afford these applications and software due to their high cost. However, our model is free, prepared using freely available open-source applications and software. We can publish them on YouTube and 3D platforms like Sketchfab, where students can freely interact with these 3D models for their anatomical study and learning process.

Our approach of creating 3D models using AI and open-source applications indicates that engaging anatomical 3D models can be created and provided to needy students and anatomy learners{25}.

We received positive feedback (Table 1) from students on YouTube, which is very encouraging and motivates us to create more such models. From the positive feedback on YouTube, it is clear that our content is very relevant and in demand. Students are requesting more such content related to the brachial plexus, internal iliac artery, etc.

Others expressed general support and encouragement by giving likes to the video, which is very motivating. It showed that our model is very helpful in their learning process of anatomy.

Our approach correctly fits with modern trends in the field of educational technology, where students can clearly visualize and interact with 3D models to learn complex anatomical structures very easily and in a very short span of time {21, 22}.

Even though YouTube statistics like view counts and likes might not be a comprehensive measure of learning effects, the measure at least gives an idea of the extent of reach and acceptance of our workflow. The growing trend of positive feedback, as it happened in our video, together with the topic suggestions that are found as positive, shows the great utility of our workflow.

If we observe, in most online platforms, the maximum audience is from developing countries, where proper educational resources are very limited{16, 17}. In this context, our workflow can play a vital role in solving this problem. We can create such AI-assisted 3D anatomical models and distribute them globally

to help learners across the world{18, 23}.

A limitation of our workflow is that our models are created in a simplified manner for teaching and learning veterinary anatomy, which may restrict their application while performing advanced surgical operations and clinical diagnosis of various disease conditions.

Another limitation of our workflow is that feedback was obtained informally through online comments from YouTube rather than through proper, experimental, structured surveys, and hence may show the views of a motivated group of students and learners. Future studies in our workflow should include formal validation of learning outcomes by comparing the performance between two groups of learners: one group with traditional teaching approaches and another group with AI-assisted 3D models.

However, regardless of these constraints, we have found that AI-assisted workflows can make highly effective production of interactive 3D anatomy models, which is cost-effective, accessible, and appreciated among learners {30}. This strategy will offer veterinary anatomy educators a new way of creating a digital ecosystem of anatomical resources worldwide {26}.

There is potential to extend this workflow to create increasingly complex anatomical structures for 3D visualization by learners and students, which can be incorporated into their educational curricula {20, 24}.

6. Conclusion

In this paper, it has been shown that AI-assisted workflows could be well utilized in creating interactive 3D veterinary anatomical models. Using a free and accessible program like Blender to create educational models and online platforms like YouTube and Sketchfab to present them, educational information with a high level of accuracy and visual interest can be made available to an exponentially large group of students and learners at very minimal cost.

The popularity of the models among learners and the further demand for extending the workflow to create more such models show not only the educational potential but also the need for such resources in training vets.

As the existing models have been kept simple to understand, they still offered rich learning content that motivates the audience to use them further. Notably, the method assists in overcoming challenges in anatomy instruction, especially in environments where conventional materials are scarce. In the future, other anatomical systems should be expanded by this workflow, and learning outcomes should be systematically appraised, which will also enhance the position of this workflow in veterinary education.

Overall, AI-assisted 3D modelling is an effective and innovative addition to traditional approaches in teaching veterinary anatomy and an accessible and scalable way of improving the global veterinary anatomy education landscape.

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