



The Use of Synthetic Media and the Creation of a Synthetic Media Pipeline in the Training of Artificial Intelligence



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Background

- Synthetic Media is any media that is generated by an AI or “deepfake”
- Why is this important?
- When there is insufficient data, Synthetic Media can be used to train AI using “deepfake” media as data
- Examples of AI that could be trained on synthetic media include:
 - Autonomous cars and trucks through use of simulation
 - Teaching chatbots how to converse by having them interact with other chatbots
 - Training chess AI by having it play itself or other AI
 - Using fake or doctored images when instructing vision detection models on what to look for

Limitations

- Creating synthetic data requires a 3D artist for the creation of 3D models
- Some quality may have been lost as we used models available online for free
- A possible future solution to that issue would be for a successful text-to-3D model AI, as that would allow the pipeline to be even more automated, cost-effective, and efficient

References

1. Community, B. O. (2018). Blender - a 3D modelling and rendering package. Stichting Blender Foundation, Amsterdam. <http://www.blender.org>
2. Sutor, J. (2022). Johnsutor/Leopardi: Generate synthetic data with Blender. GitHub. <https://github.com/johnsutor/leopardi>
3. Jocher, G., Chaurasia, A., & Qiu, J. (2023). Ultralytics YOLO (Version 8.0.0) [Computer software]. <https://github.com/ultralytics/ultralytics>
4. Autonomous Vehicle Developers Prepare for a Long Road to Autonomy. IEEE Innovation at Work. (2020, February 27). <https://innovationatwork.ieee.org/autonomous-vehicle-developers-prepare-for-a-long-road-to-autonomy/>



Methods: One Application – The Process of a Synthetic Media Pipeline for a Computer Vision AI



1

- Begin with a 3D Model of an object you would like the AI to identify. Using *Blender*¹, rename the file to reflect the object class
- For example, a 3D shark model would be named shark.stl

2

- Training works better when the image has a background. It’s best to make it as “noisy” as possible
- *Leopardi*² is custom software developed to generate training images for computer vision AI

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- Using *Blender*, *Leopardi* positions the camera in random location on a hemisphere above the 3D model
- At each point, a 2D snapshot is taken, and a background is added to make a complete picture
- The image is saved along with a text file with training data—the object’s bounding box and the object (file) name:
Shark 0.283 0.980 0.301 1.00
- Can generate up to 15,000 labeled images per hour

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- After the synthetic dataset is finished, the images are used to train *YOLO*³, a Deep Neural Network computer vision AI
- Note: it’s best to use a small amount (8%) of authentic images
- The model uses the information in the text file to learn the image’s shapes as well as the associated name
- It will then be able to identify the object in images and put a bounding box around it containing the name and an accuracy metric

Conclusions and Results

- The Synthetic Media Pipeline allows our lab to create highly accurate vision detection AI
- The ability to synthetically train AI is an important tool, as it makes creating, updating, and storing data efficient and cost-effective
- The greatest example of this efficiency is *Leopardi*’s ability to take 15,000 images an hour
- This is significantly more cost-effective and efficient in comparison to the process required for hand-labeled data, which includes hiring actors, setting up props, and labeling/managing the images
- Consequently, the AI industry has already embraced the use of synthetic media
- One of the most important areas of application is in the field of autonomous cars and trucks, which needs 11 billion miles worth of on-the-road footage in order to properly train the model.⁴
- This is an impossible amount of data to obtain without the use of synthetic media

