# 🤔 Motivation: what problem are we tackling

In extended reality (XR), the integration of pets into virtual spaces is has created for a wide range of new possibilities. However, there's still a significant void in understanding the emotional nuances of pets in XR. We will try to enhance the technology by developing a model that (a) identifies between two different pet types (cats and dogs) and (b) classify between different facial expressions (happy, sad, and angry).

Motivated by the growth of XR based technologies and the value of pets in human mental health, we will aim to integrate pets into XR. This will not only accommodate the preferences of the user in question but also enhances the overall immersive experience in human-pet interaction.

**Potential use case:**

Our model could find it's application in remote pet monitoring for healthcare assessment. For instance: by using [trail cameras](https://en.wikipedia.org/wiki/Remote_camera) biologists, researchers, or even hobbyist could remotely look at the emotional state of an animal; conclude distress; behavioural change and so forth. We think this model has huge potential, especially when this model could get extended to multiple animals and multiple emotions.

# 💡 Solution

**Pre-trained model**: Using a pre-trained CNN (e.g. ResNet for example Joerie uses this in his thesis as well) can be used as a base. These models have shown their success in image classification to capture feature vectors.

**Custom model**: Using ML techniques/principles from the course we can make a customized CNN architecture with added convolutional layers and pool layers for feature extraction and spatial reduction respectively

# 🧮 Method

Our solution will have the following chronological steps

1. Load data by storing each image path in a list and it's corresponding label in another
2. Transform the lists into a data frame
3. Exploratory Data Analysis (EDA) and analyse data to get more insights (just like we did in all the labs, explore data get familiar with it)
4. Make train, test, and validate sets
5. Make Data Generator (DG) for Train, Test and Validate set. We can use TensorFlow Generator for it.
6. Load the pre trained model; add some layers; compile. (here will our own code be injected probably)
7. Evaluate the result by plotting results (also like in the labs)

# First results

# 📚 Resources

## 📑 Papers

[1] \*Wood, E. et al. (2022). \*\*3D Face Reconstruction with Dense Landmarks\*\*. In: Avidan, S., Brostow, G.\*, Cissé, M., Farinella, G.M., Hassner, T. (eds) Computer Vision – ECCV 2022. ECCV 2022. Lecture Notes in Computer Science, vol 13673. Springer, Cham(https://doi.org/10.1007/978-3-031-19778-9\_10)

[2] \*Lawin, F. J., Moeller, M.-M., & Petersson, L\*. (2017). \*\*MVSNet: Depth Inference for Unstructured Multi-view Stereo.\*\* Computer Vision and Pattern Recognition (CVPR).(https://arxiv.org/abs/1703.06870)

[3] \*Fanzi Wu, Linchao Bao, Yajing Chen, Yonggen Ling, Yibing Song, Songnan Li, King Ngi Ngan, Wei Liu\*. (2019). \*\*MVF-Net: Multi-View 3D Face Morphable Model Regression\*\*. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2019, pp. 959-968 (https://arxiv.org/abs/1703.06870)

[4] \*Vasquez-Gomez, J.I., Troncoso, D., Becerra, I. et al\*. \*\*Next-best-view regression using a 3D convolutional neural network\*\*. Machine Vision and Applications 32, 42 (2021). (https://doi.org/10.1007/s00138-020-01166-2)

[5] \*Y. Choi, Y. Uh, J. Yoo and J. -W. Ha\*, \*\*StarGAN v2: Diverse Image Synthesis for Multiple Domains\*\*. 2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), Seattle, WA, USA, 2020, pp. 8185-8194.(https://doi.org/10.1109/CVPR42600.2020.00821)

[6] \*A. S. Jackson, A. Bulat, V. Argyriou and G. Tzimiropoulos\*, \*\*Large Pose 3D Face Reconstruction from a Single Image via Direct Volumetric CNN Regression\*\*, 2017 IEEE International Conference on Computer Vision (ICCV), Venice, Italy, 2017, pp. 1031-1039, doi: 10.1109/ICCV.2017.117.(https://doi.org/10.1109/ICCV.2017.117)

[7] \*J. Zhang, H. Hu and S. Feng\*, \*\*Robust Facial Landmark Detection via Heatmap-Offset Regression\*\*, in IEEE Transactions on Image Processing, vol. 29, pp. 5050-5064, 2020.(https://doi.org/10.1109/TIP.2020.2976765)

## 📊 Datasets

pet's facial expression

* [Kaggle 🐶Pet's Facial Expression Image Dataset😸](https://www.kaggle.com/datasets/anshtanwar/pets-facial-expression-dataset/data)
* [Kaggle Animal faces](https://www.kaggle.com/datasets/andrewmvd/animal-faces/data)

## 💻 Project Inspiration

* [CNN | Beginners | 🐶Pet's Expression Recognition](https://www.kaggle.com/code/anshtanwar/cnn-beginners-pet-s-expression-recognition)
* [500 ML Project](https://github.com/ashishpatel26/500-AI-Machine-learning-Deep-learning-Computer-vision-NLP-Projects-with-code)
* <a name="facial\_landmark"></a>
* [Facial Landmark and Image Morhphine: Species](https://github.com/emreslyn/facial\_landmark\_and\_image\_morphing)