Artificial Intelligence – Week 10

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Course Repository:
https://github.com/kaopanboonyuen/SC310005_ArtificialIntelligence_2025s1

🎯 Objective

This week, you will explore the YOLOv8 family models (n, s, m, l, x) on the Brain Tumor Detection dataset and analyze their performance. Your goal is to train, evaluate, and compare models while experimenting with advanced techniques to improve results.

You will:
✅ Download and prepare the Brain Tumor Detection dataset
✅ Train YOLOv8 models of all sizes (n, s, m, l, x)
✅ Evaluate each model on validation data and compare performance
✅ Experiment with techniques like data augmentation, focal loss, or fine-tuning to improve results
✅ Document your process, results, and observations

📚 Dataset

Brain Tumor Detection (Ultralytics format):
Download Link
(https://github.com/kaopanboonyuen/panboonyuen_dataset/raw/main/public_dataset/ultralytics_dataset/brain-tumor.zip)

📚 Topic Focus

- YOLOv8 family overview: n, s, m, l, x
- Binary object detection for brain tumors
- Techniques to handle dataset challenges (small dataset, class imbalance)
- Data augmentation and tricks to improve performance
  Fine-tuning pretrained weights

📝 Assignment Instructions

1. **Prepare Dataset**
    - Download and unzip dataset in Colab or local machine
    - Verify `.yaml` paths are correct
    - Optional: visualize random samples
2. **Train YOLO Models**
    - Train all YOLOv8 family models: n, s, m, l, x
    - Recommended epochs: 30–50
    - Track training metrics (loss, mAP, F1)
3. **Evaluate Models**
    - Use validation set to compute metrics
    - Compare speed vs accuracy of different families
4. **Experiment & Improve**
    - Apply tricks like:
        - Focal Loss for imbalanced classes
        - Data augmentation (flip, mosaic, color jitter)
        - Fine-tuning pre-trained weights
    - Optional: try to beat larger models with clever techniques → **extra points**
5. **Document & Submit**
    - Present results in a table or chart: model, mAP, F1, inference speed
    - Highlight the “winning” model and justify why
    - Bonus: describe any tricks you applied that improved performance

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💡 Tips for Students

- Keep consistent folder structure: `/images/train`, `/images/val`, `/labels/train`, `/labels/val`
- Start with YOLOv8n to quickly test, then scale to larger families
- Validate predictions visually → catch annotation or preprocessing mistakes
- Use augmentation and class-weight tricks to handle imbalance

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🎨 Deliverables

- Report / Notebook: Python scripts or Colab notebook
- Include: training logs, evaluation metrics, sample inference images
- Optional: bonus points if clever techniques outperform larger models

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🚀 Getting Started

- Dataset: Brain Tumor Detection (https://github.com/kaopanboonyuen/panboonyuen_dataset/raw/main/public_dataset/ultralytics_dataset/brain-tumor.zip)
- YOLOv8 Documentation: https://docs.ultralytics.com

📅 Submission Deadline

To be announced in class. Submit via LMS or GitHub Classroom.

Good luck and be creative! 🎨🤖

Try to beat all YOLO families using your tricks—let the model you design do the teaching!