Given a **query image patch** containing a fine-grained object (e.g., a specific bird species, a car model, or a brand logo), retrieve all images from a **large database** that contain the **same object**, even if the object appears at **different scales, partial occlusions**, or is embedded in **cluttered scenes**.

You are provided with:

- A **query image patch** (small cropped region with the object of interest).
- A **search set of images** (large, high-resolution, cluttered images with multiple objects).
- Bounding box annotations (for training only) for the object in some of the search images.

Your goal:

1. **Frame this problem formally as a deep learning task.**
2. **Propose an end-to-end CNN-based model** that can retrieve all images containing the same object (instance-level retrieval).
3. **Design an appropriate loss function** to handle **scale invariance**, **partial occlusion**, and **background clutter**.
4. Optionally, propose **efficiency improvements** for large-scale retrieval.

# You need to submit:

- Report (max 6 pages) with the following sections:
    - Problem Formulation
    - Model Architecture
    - Loss Function
    - Evaluation Strategy
    - Conclusion