

# VIOLA: Video Labeling for Security Domains

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# Green Security Domain

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Endangered Wildlife



Fisheries



Environmental Resources



# Challenges in Green Security

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- ▶ Bounded Rationality
  - Attackers not perfectly rational
  - Learn actions from historical poaching activity or behavior models
- ▶ How to acquire data for behavior model learning
  - Videos of adversary activities in green security domains

# Applications of Videos in Security



Photo credit: [https://ak9.picdn.net/shutterstock/videos/6844699/thumb/12.jpg?i10c=img.resize\(height:160\)](https://ak9.picdn.net/shutterstock/videos/6844699/thumb/12.jpg?i10c=img.resize(height:160)), [https://ak3.picdn.net/shutterstock/videos/6043853/thumb/1.jpg?i10c=img.resize\(height:160\)](https://ak3.picdn.net/shutterstock/videos/6043853/thumb/1.jpg?i10c=img.resize(height:160)),  
<https://ak7.picdn.net/shutterstock/videos/30758257/thumb/1.jpg>



# Applications of Videos in Security

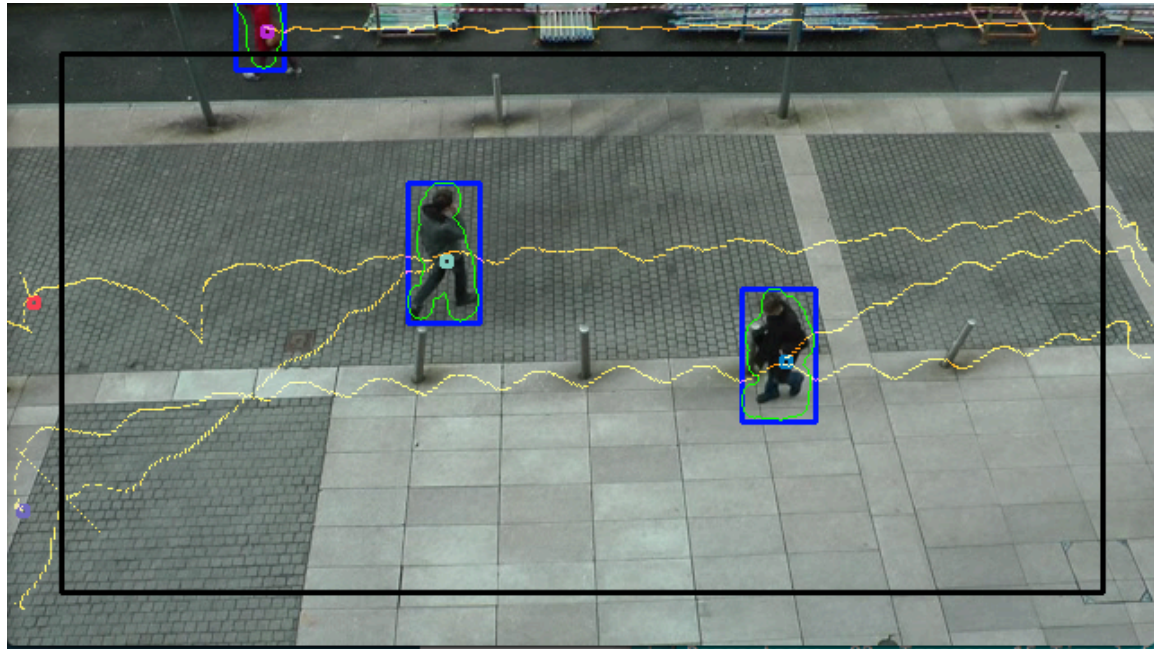
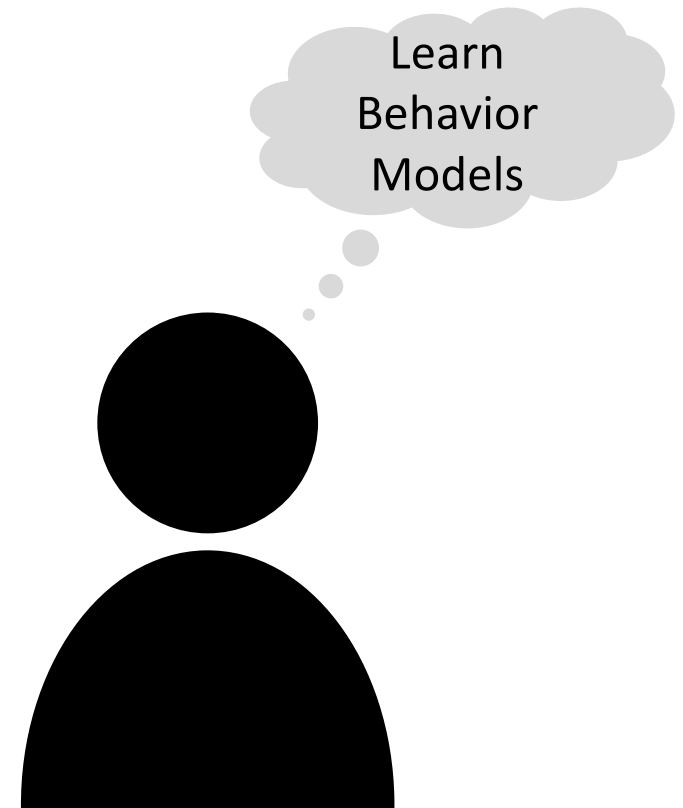
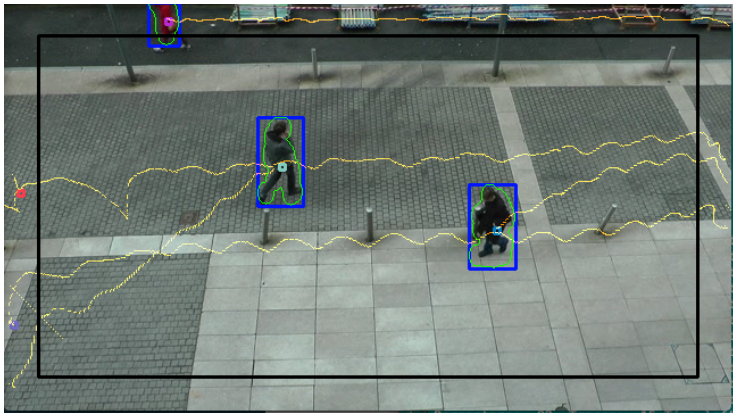


Photo credit: <http://juliericowilliamson.com/PedestrianTracking/images/demo.png>

# Applications of Videos in Security



# Problem

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# Solution

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# Solution

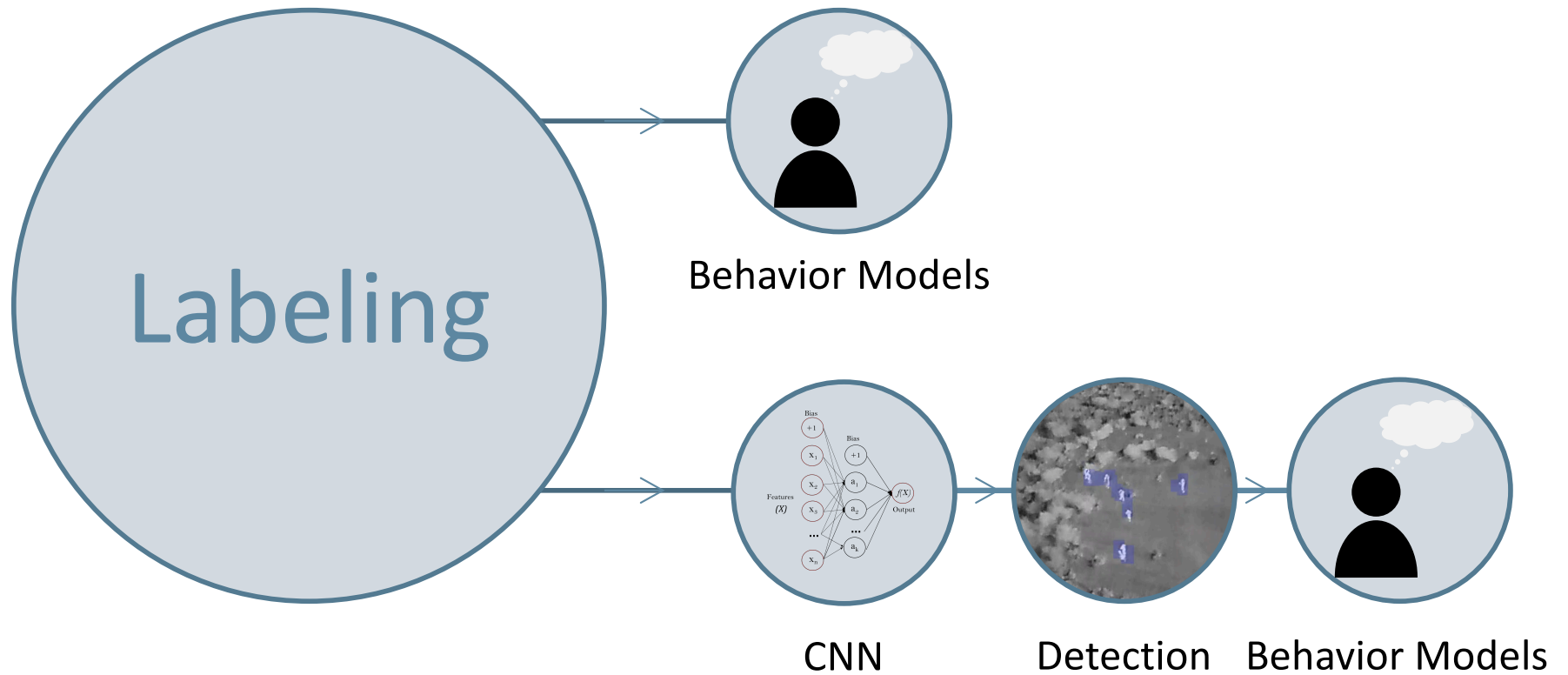


Photo credit: [http://scikit-learn.org/stable/images/multilayerperceptron\\_network.png](http://scikit-learn.org/stable/images/multilayerperceptron_network.png)



# Solution

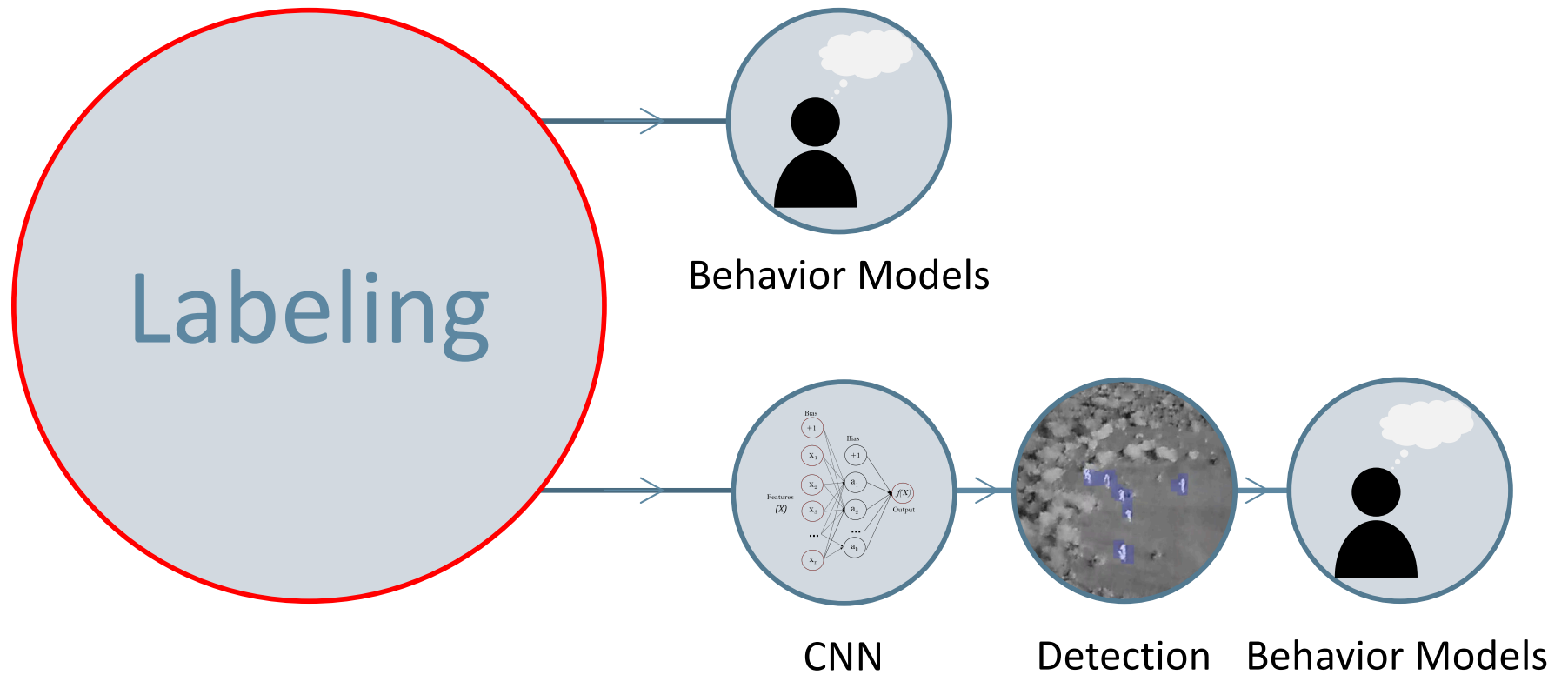
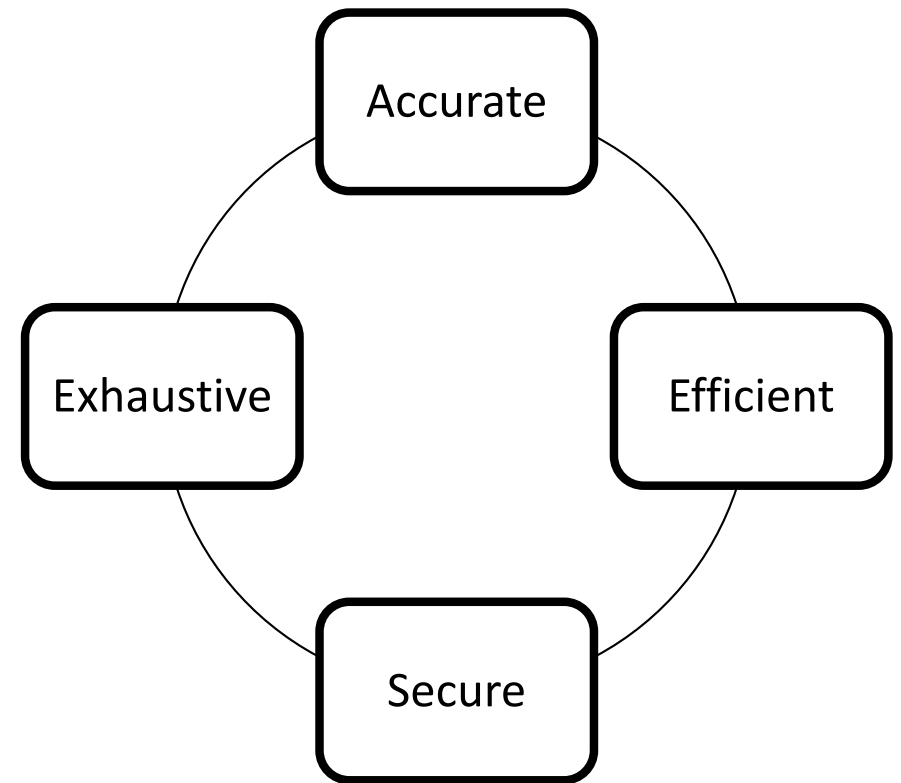


Photo credit: [http://scikit-learn.org/stable/\\_images/multilayerperceptron\\_network.png](http://scikit-learn.org/stable/_images/multilayerperceptron_network.png)

# VIOLA



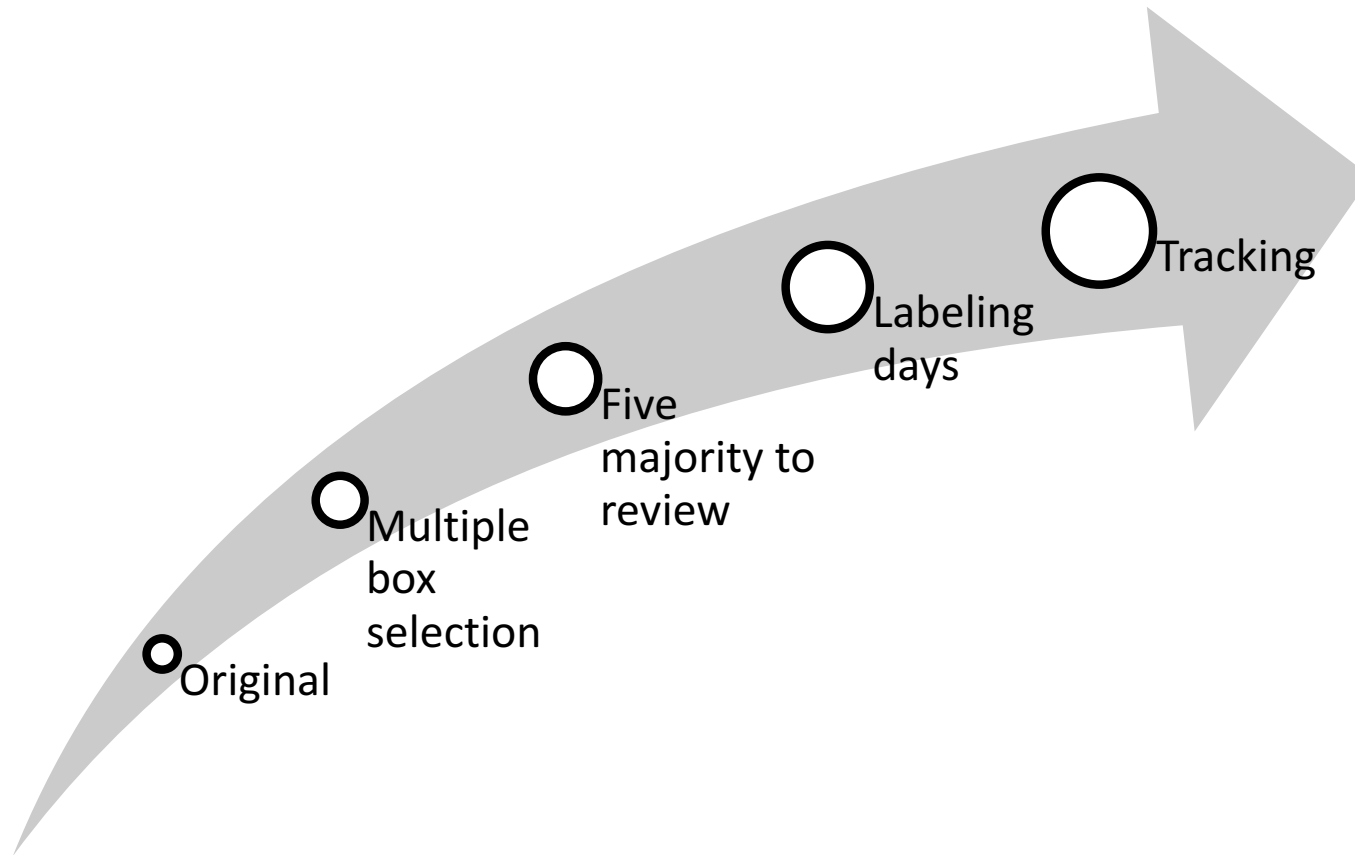
# Outline

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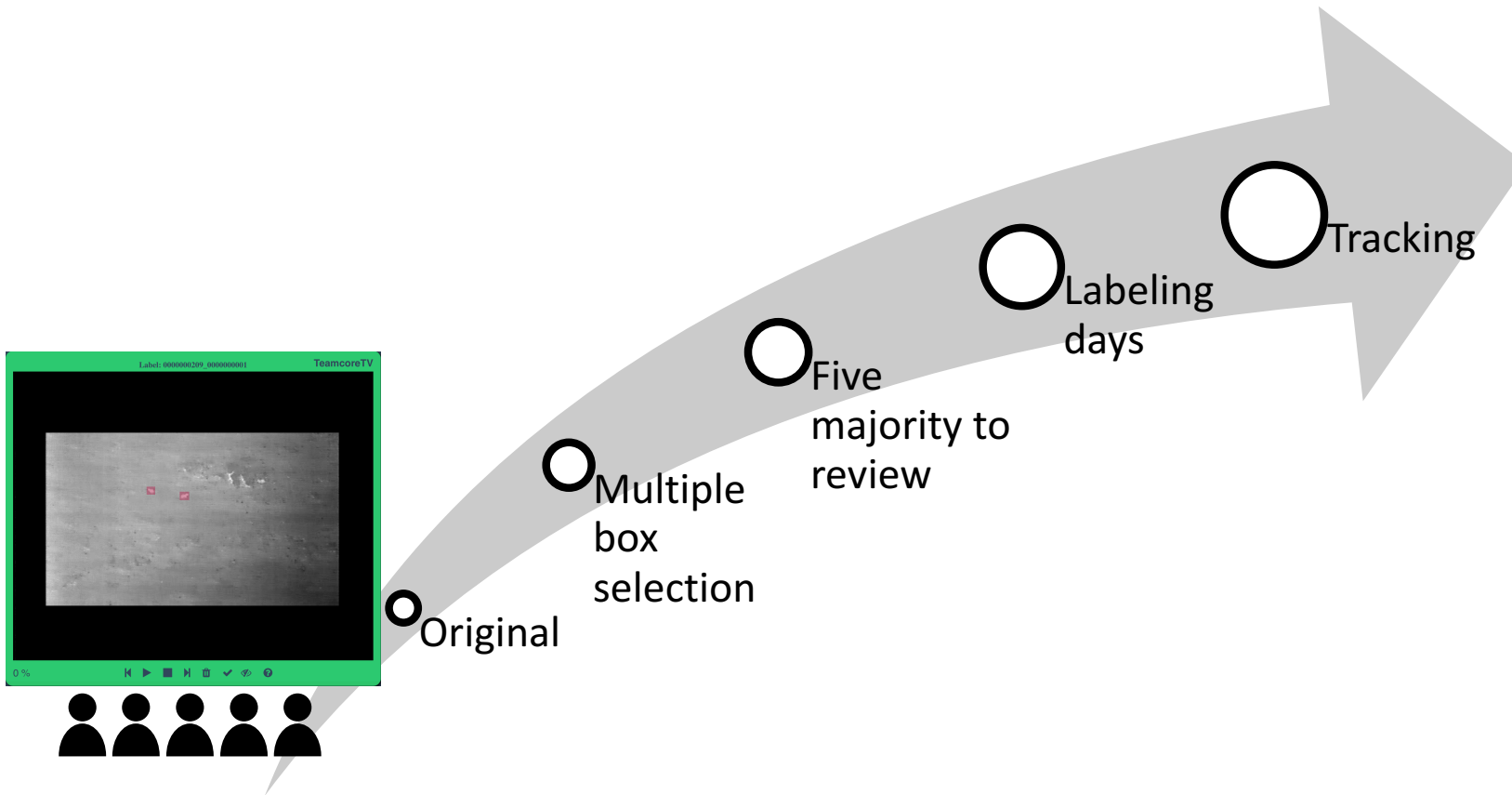
- ▶ Contributions of VIOLA:
  - Built for labeling thermal infrared data (or other difficult video data) more easily
  - Designed to use without AMT to keep data secure
- ▶ Outline:
  - Efficiency efforts
  - Workload distribution framework towards exhaustive and accurate labels
  - Security efforts

# VIOLA: Efficiency

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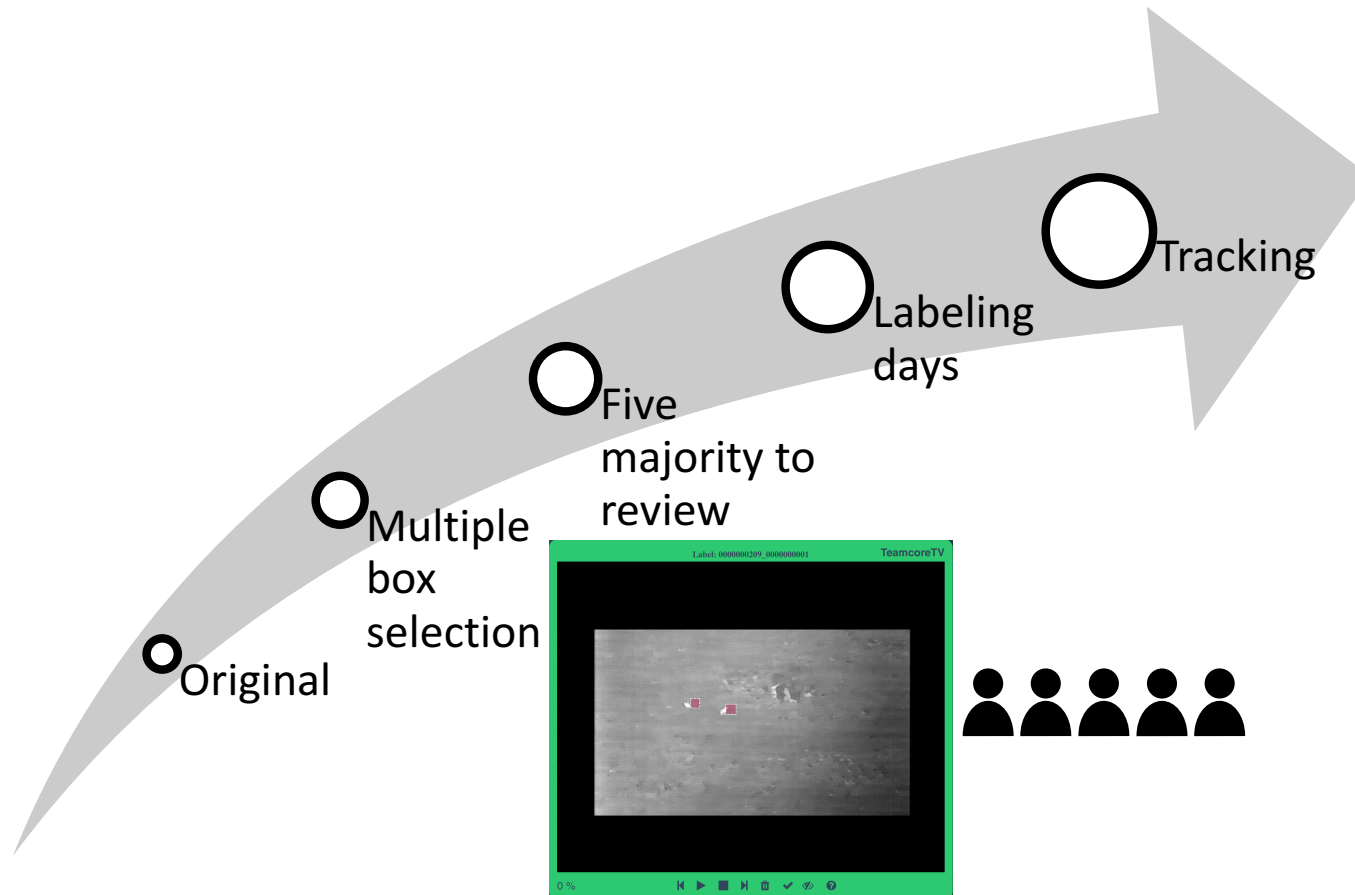


# VIOLA: Efficiency

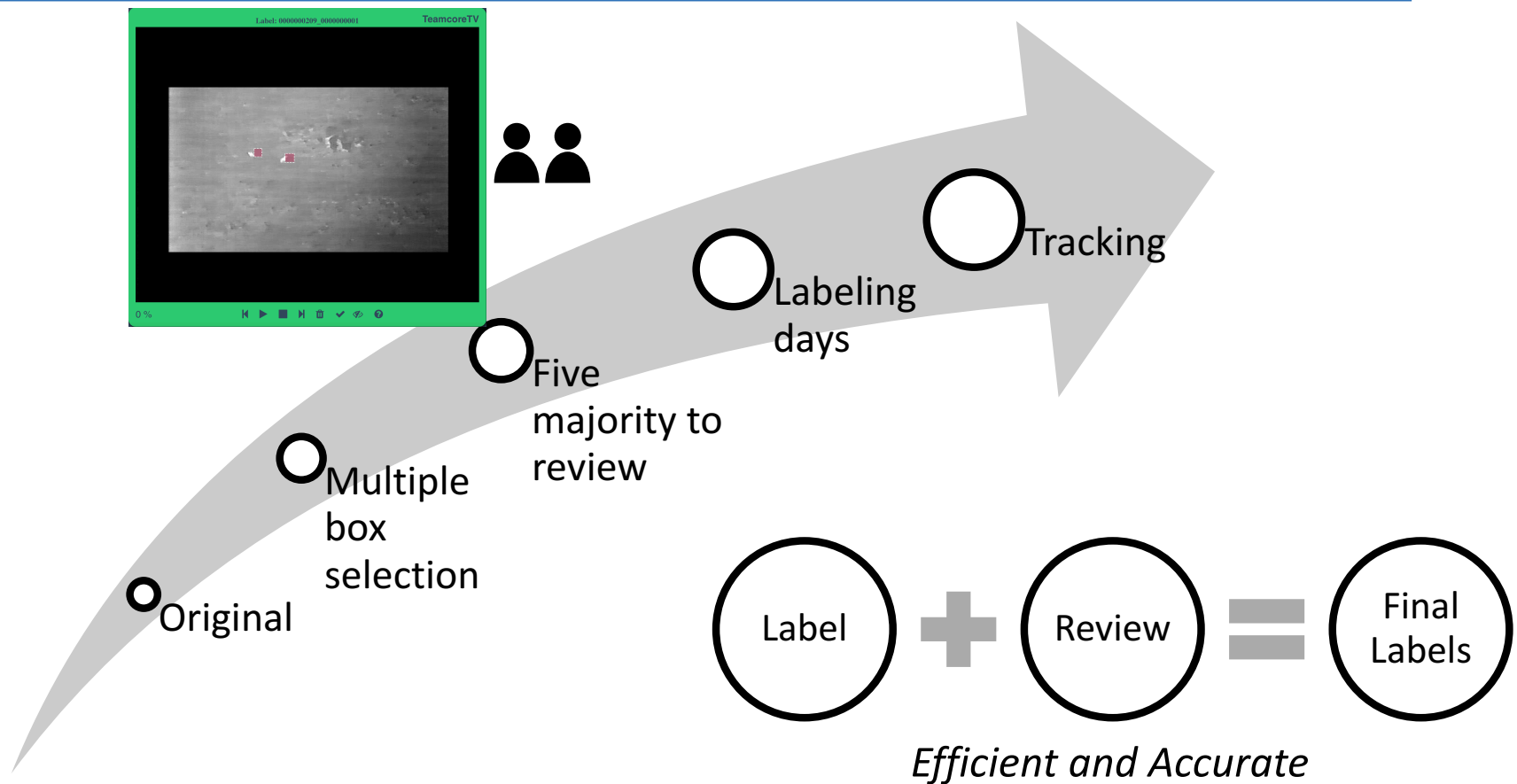




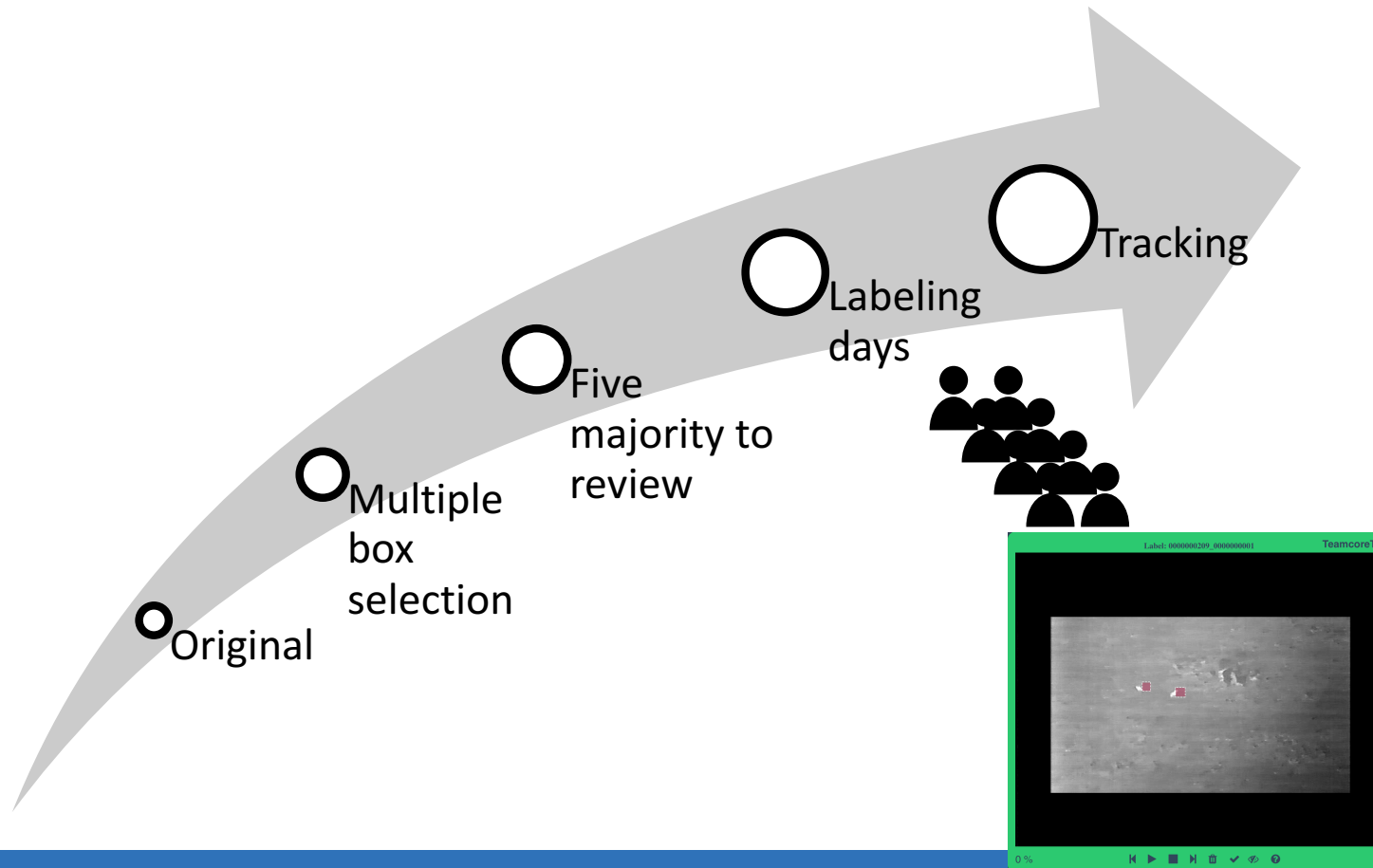
# VIOLA: Efficiency



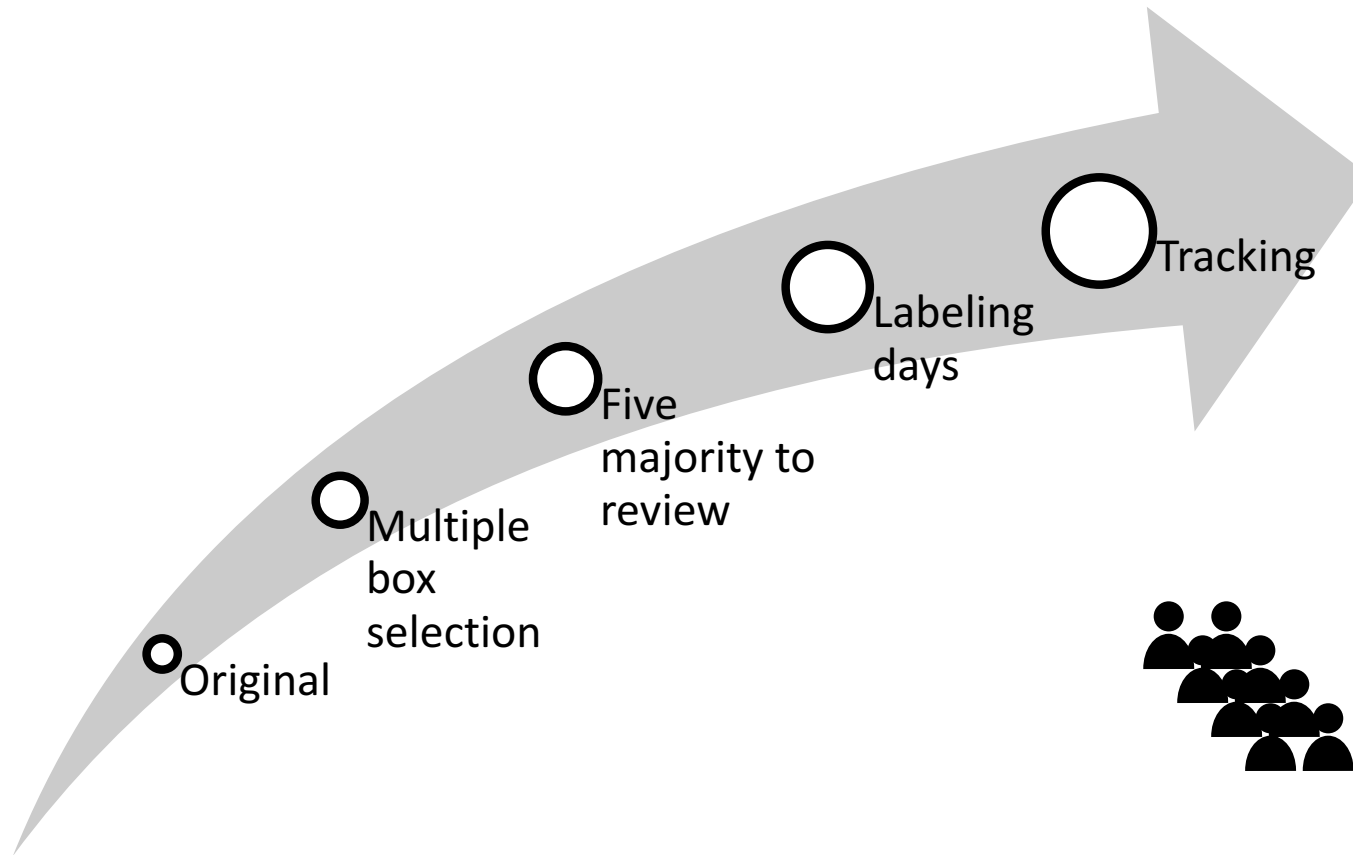
# VIOLA: Efficiency



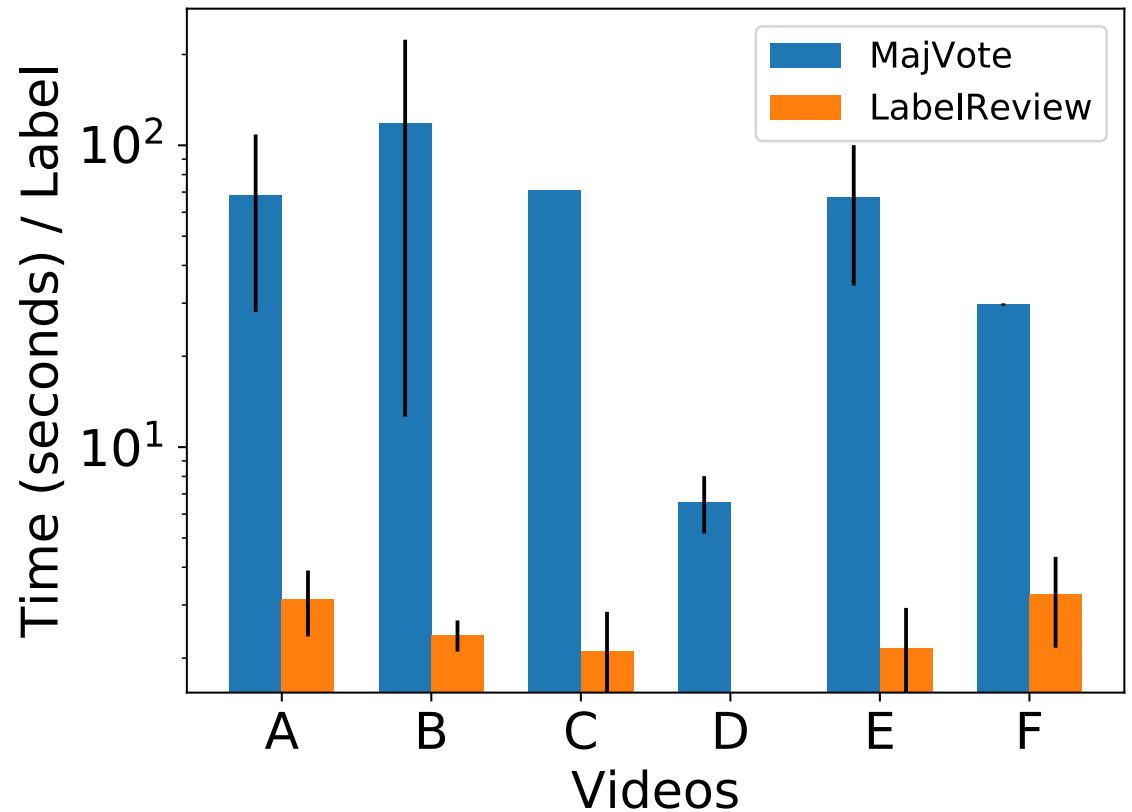
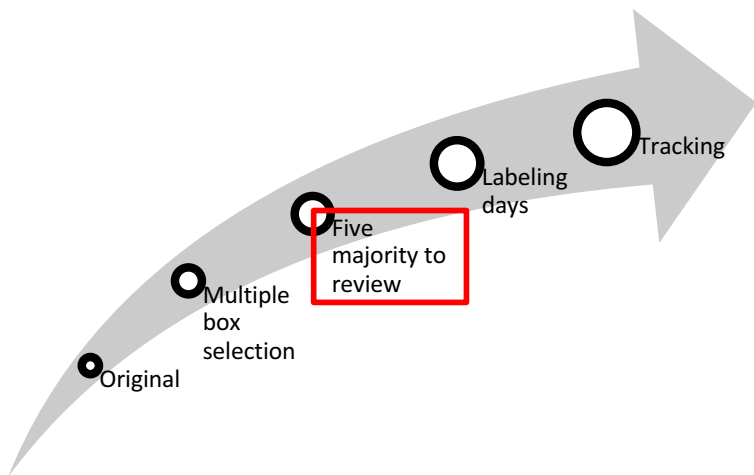
# VIOLA: Efficiency



# VIOLA: Efficiency



# Efficiency Analysis





# VIOLA: Secure

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Log in to ec2-52-35-132-17.us-west-2.compute.amazonaws.com:8080

Your password will be sent unencrypted.

User Name

Password

☐ Remember this password

Cancel Log In

# Using VIOLA

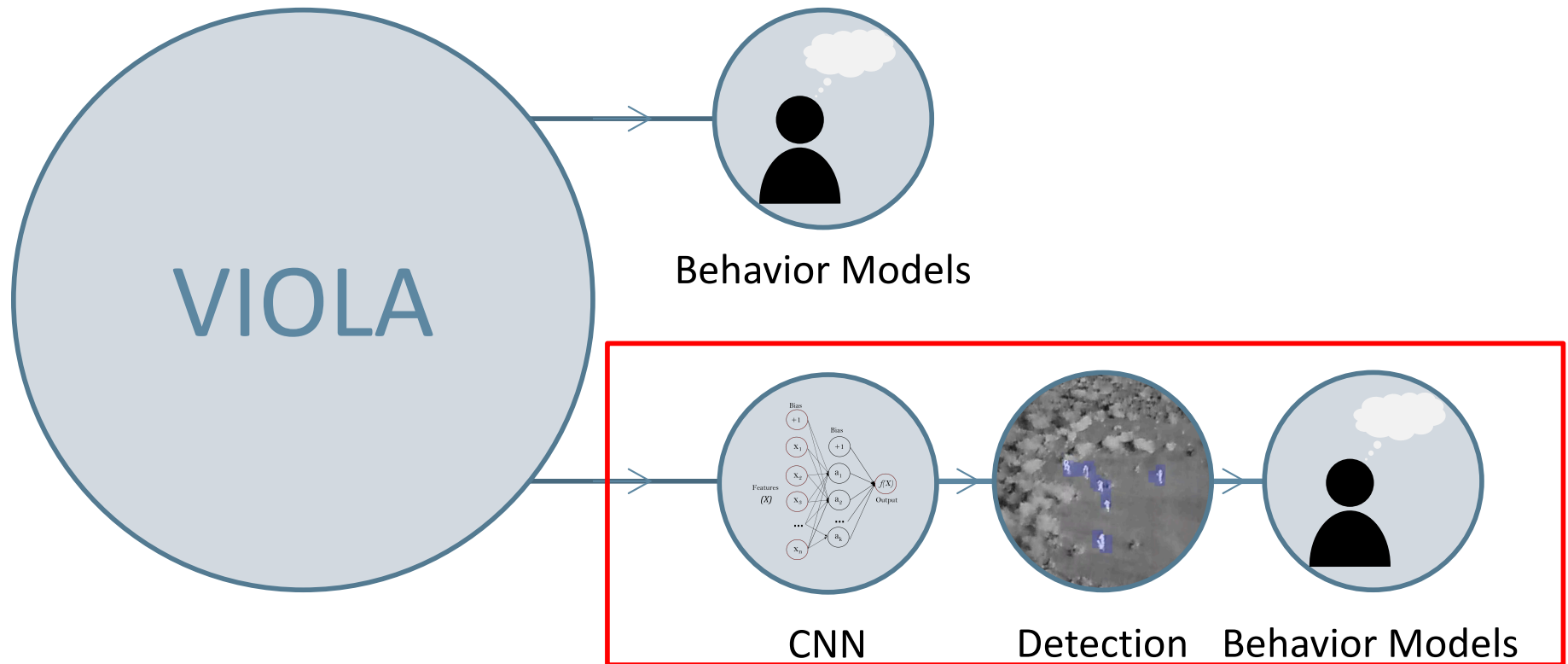
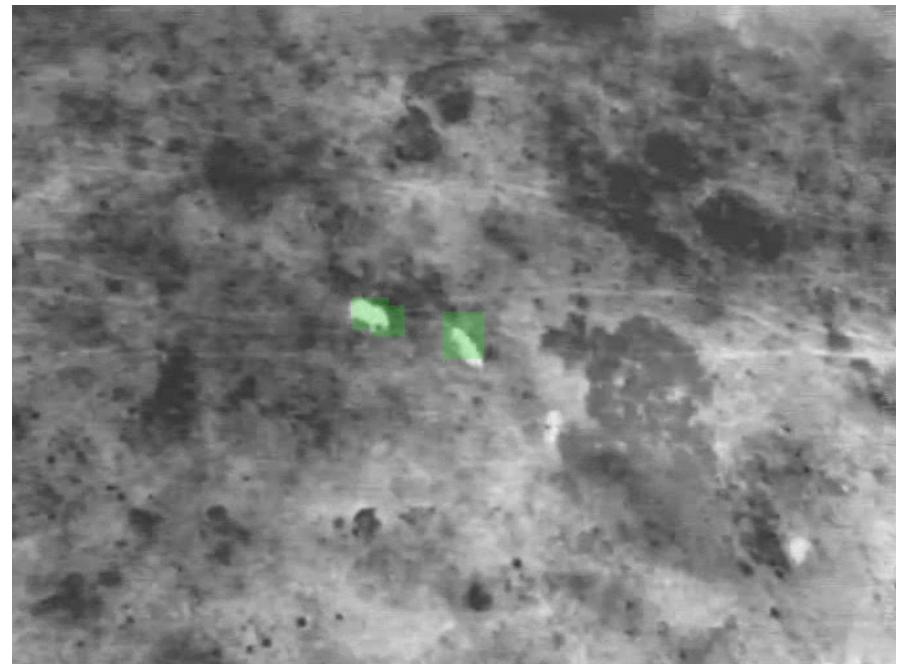


Photo credit: [http://scikit-learn.org/stable/images/multilayerperceptron\\_network.png](http://scikit-learn.org/stable/images/multilayerperceptron_network.png)

# More Difficult Detection Successes

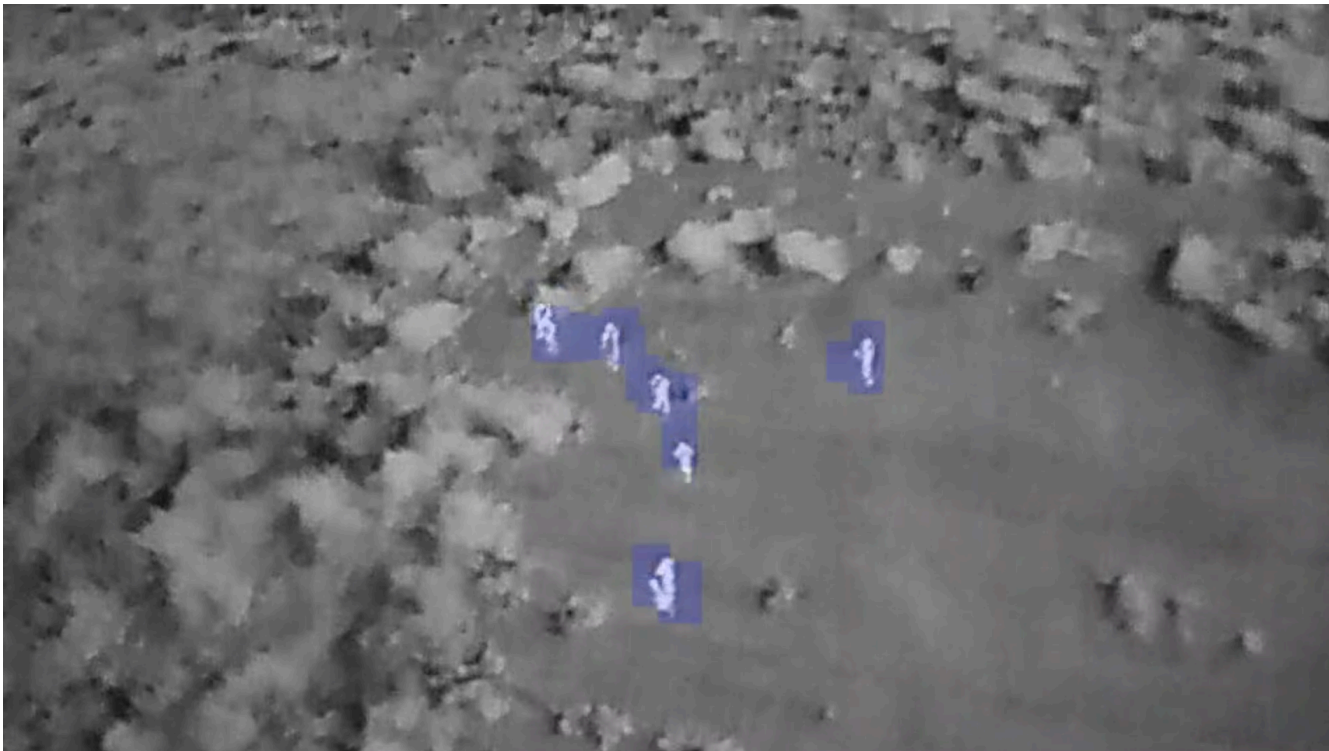


# Conclusions

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- ▶ Security videos: labeling → CNN → detection → behavior models
- ▶ VIOLA:
  - Labeling interface for (any) difficult video data
  - Towards Secure, Accurate and Exhaustive, Efficient tool
- ▶ Now:
  - 70 videos labeled, ~180,000 individual bounding boxes
  - Automatically detect wildlife and poachers in real time
- ▶ Future: behavior model and route planning with real-time information

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# Efficiency Analysis

