# Allsky Camera Network for Detecting Bolides

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# Task Matrix (Milestone 3)

| Task | Completion | Tyler | Vincent | Jean-Pierre | Charles |
|---|---|---|---|---|---|
| Replace current C++ camera code | 100% | 10% | 35% | 45% | 10% |
| Implement Server API | 99% | 50% | 0% | 50% | 0% |
| Implement Client API | 99% | 20% | 0% | 20% | 60% |
| Begin writing CLI | 30% | 30% | 10% | 50% | 10% |
| IoT Style Setup | 99% | 20% | 0% | 10% | 70% |
| Classification | 99% | 0% | 33% | 33% | 34% |
| Start Writing UI | 0% | 20% | 70% | 0% | 10% |
| Create setup process for node | 75% | 75% | 0% | 25% | 0% |

# Task Discussion

Replace Current C++ Camera Code -> Node records and sends videos in 10 minute chunks

Implement Server API -> Consumer queue that workers pull from to process video

Implement Client API -> Configuration moved to .env, made gps integration easier

Begin writing CLI -> Classification pipeline written

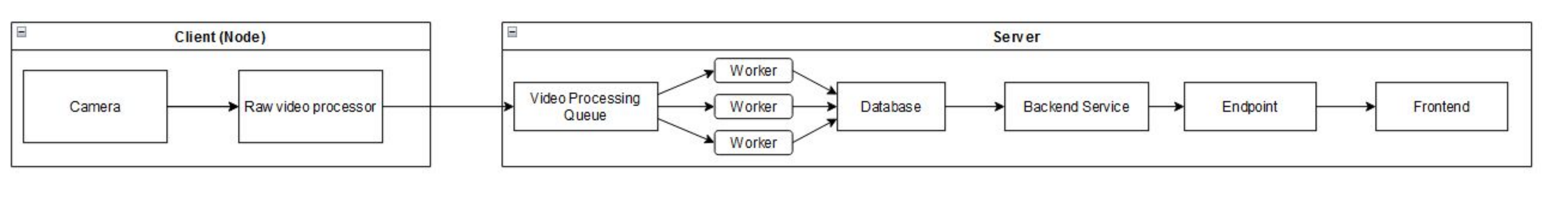
IoT Style Setup -> Still need to add captive portal

Classification -> Complete, may need to look into a transformer for even better accuracy. Still needs to be tested “in the wild”.

Start Writing UI -> No physical work was done on this, only “work” done was throwing ideas around

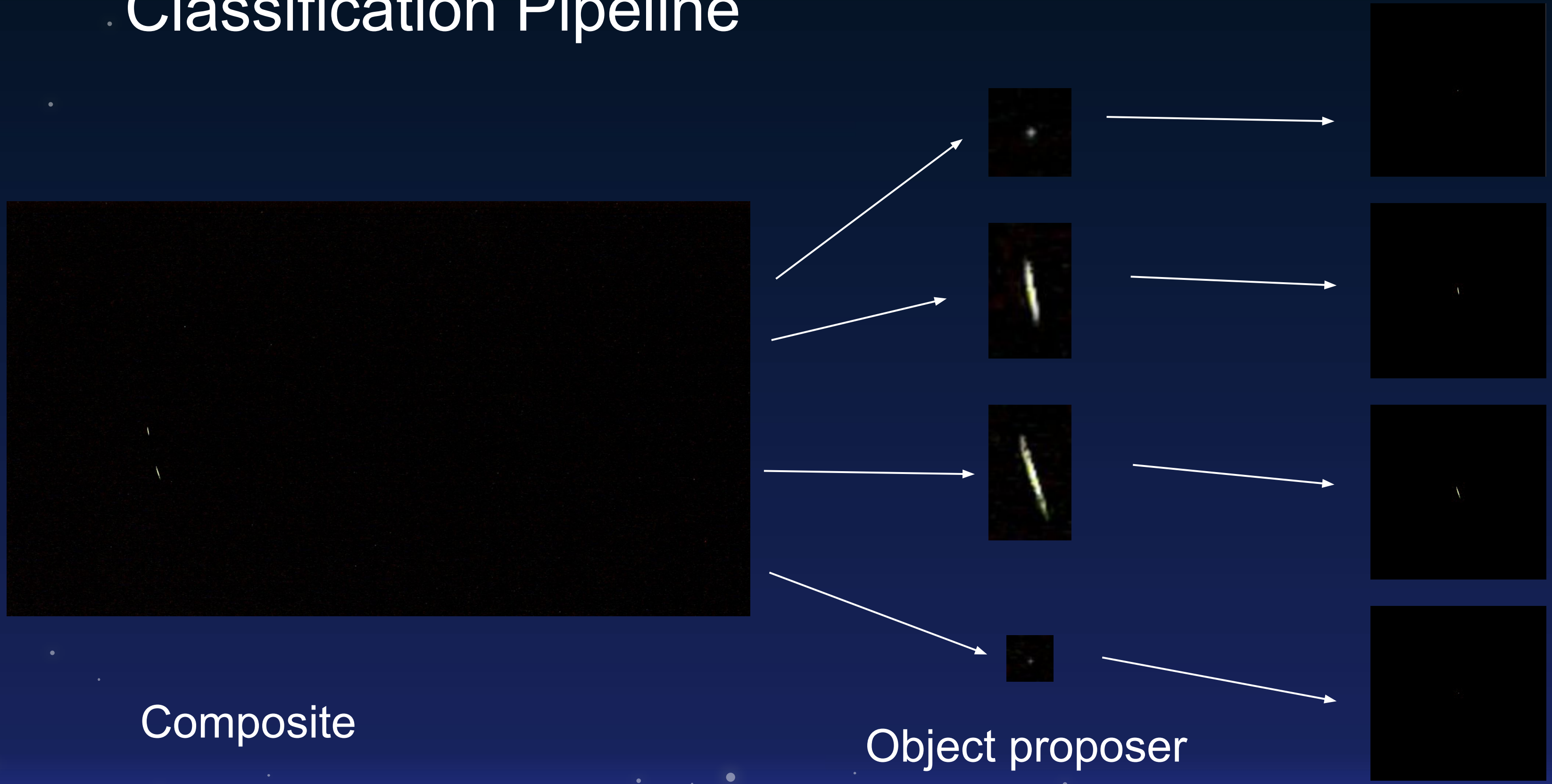
Create Setup Process for Node -> Ansible playbook that dictates all of the software and configuration a node needs to operate

# The life of a video



# Classification Pipeline

# Classification Pipeline



Composite

Object proposer

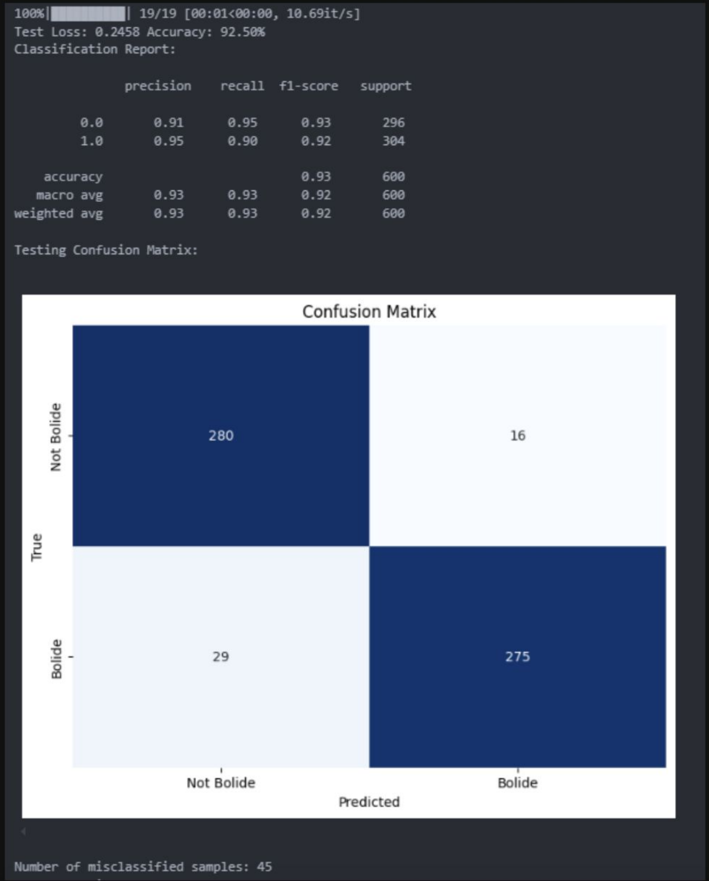
Molding to 512x512

# Bolide Classification Model

- Dataset size: 4000
- 70-15-15 train, validation, test split
- Label encodings: {'bolides': 0, 'notbolides': 1}
- 4000 samples, 2000 of them are notbolide, and 2000 of them are bolide
- Hyperparams:
    - lr = 0.001
    - epochs = 20
    - loss = BCELoss (Binary Cross Entropy Loss)
    - Adam optimizer
- Inputs are transformed to 128x128, making training much faster

a. Decreasing kernel sizes 7 -> 5 -> 3 -> 3

```
self.conv1 = nn.Conv2d(in_channels=3, out_channels=32, kernel_size=7, padding=3)
self.conv2 = nn.Conv2d(in_channels=32, out_channels=64, kernel_size=5, padding=2)
self.conv3 = nn.Conv2d(in_channels=64, out_channels=128, kernel_size=3, padding=1)
self.conv4 = nn.Conv2d(in_channels=128, out_channels=256, kernel_size=3, padding=1)
```

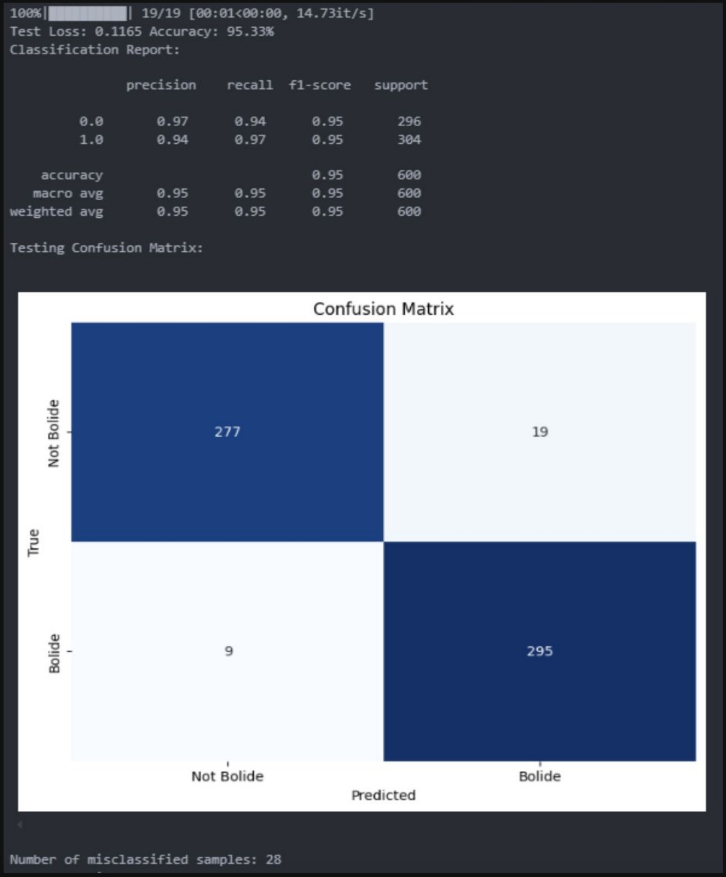


```
100%|██████████| 19/19 [00:01<00:00, 10.69it/s]
Test Loss: 0.2458 Accuracy: 92.50%
Classification Report:

              precision    recall  f1-score   support

         0.0       0.91      0.95      0.93       296
         1.0       0.95      0.90      0.92       304

    accuracy                           0.93       600
   macro avg       0.93      0.93      0.92       600
weighted avg       0.93      0.93      0.92       600

Testing Confusion Matrix:
```

```
Number of misclassified samples: 45
```

b. Constant kernel sizes 3 -> 3 -> 3 -> 3

```
self.conv1 = nn.Conv2d(in_channels=3, out_channels=32, kernel_size=3, padding=1)
self.conv2 = nn.Conv2d(in_channels=32, out_channels=64, kernel_size=3, padding=1)
self.conv3 = nn.Conv2d(in_channels=64, out_channels=128, kernel_size=3, padding=1)
self.conv4 = nn.Conv2d(in_channels=128, out_channels=256, kernel_size=3, padding=1)
```



```
100%|██████████| 19/19 [00:01<00:00, 14.73it/s]
Test Loss: 0.1165 Accuracy: 95.33%
Classification Report:

              precision    recall  f1-score   support

         0.0       0.97      0.94      0.95       296
         1.0       0.94      0.97      0.95       304

    accuracy                           0.95       600
   macro avg       0.95      0.95      0.95       600
weighted avg       0.95      0.95      0.95       600

Testing Confusion Matrix:
```

```
Number of misclassified samples: 28
```

# Contribution of Each Member

Tyler Turner

- Looked into captive portal for IoT
- Worked heavily on both APIs and implemented video sending
- Node setup (Ansible playbook)

Vincent Quintero

- Implemented video composites
- Implemented data augmentation for training model

# Contribution of Each Member

Jean-Pierre Derbes

- Trained and tuned classification model
- Implemented classification pipeline

Charles Derbes

- Designed classification pipeline
- Implemented object proposer and molder

# Task Matrix (Milestone 4)

| Task | Tyler | Vincent | Jean-Pierre | Charles |
|---|---|---|---|---|
| Implement UI | 10% | 50% | 0% | 40% |
| Polish Server | 50% | 20% | 30% | 0% |
| Polish Client | 30% | 20% | 20% | 30% |
| UI Tests | 0% | 0% | 50% | 50% |
| Server Tests | 50% | 0% | 50% | 0% |
| Client Tests | 0% | 0% | 50% | 50% |
| Create setup process for Node | 75% | 0% | 25% | 0% |

# Task Discussion

- Implement UI -> Implement a UI and use researcher feedback to enhance UX.
- Polish Server -> Bugs and performance issues.
- Polish Client -> Video sending needs more testing since it is a core functionality.
- UI Tests -> End-to-end tests using Playwright.
- Server Tests -> Unit tests for each part.
- Create Setup Process for Node -> Hardware testing suite.

# Thanks!