

The background is a composite image. The upper portion shows a dark space filled with stars and a glowing, colorful nebula in shades of blue, green, and orange. The lower portion shows a view of the Earth from space, with brown landmasses and blue oceans. A bright, glowing blue and white light source, possibly a star or a distant galaxy, is visible on the right side, creating a lens flare effect.

HALO:

High-efficiency Autonomous Low-SWaP Operations

Sloan Hatter, Blake Gisclair
Advisor: Dr. Ryan T. White

MILESTONE 1 PROGRESS MATRIX

Task	Completion %	Sloan	To Do
Literature Review	100%	Research	None
Load ViT onto Raspberry Pi	95%	Interface with hardware	Write custom post-processing scripts
Requirement Document	100%	Write 100%	None
Design Document	100%	Write 100%	None
Test Plan	100%	Write 100%	None

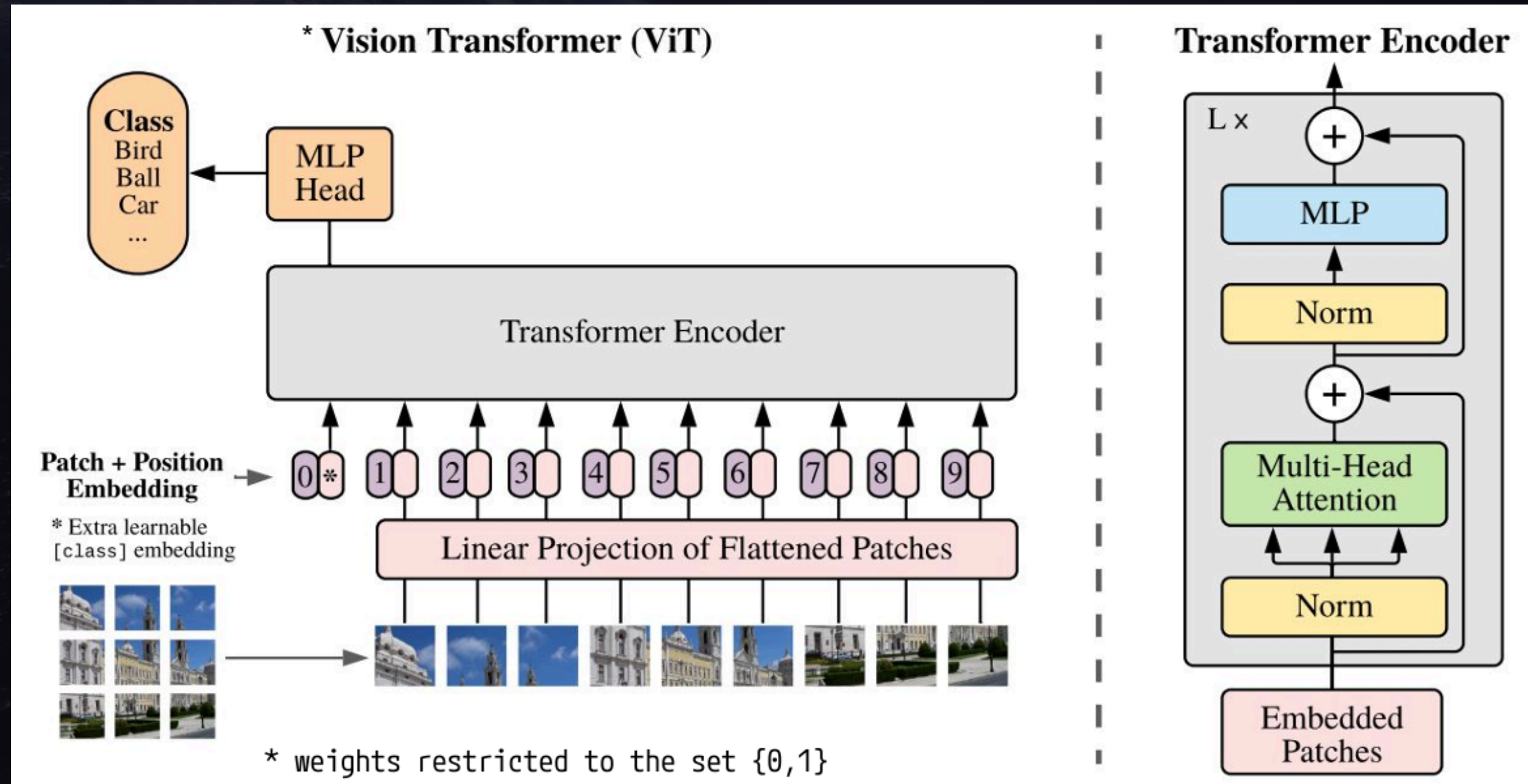
TECHNICAL RESOLUTIONS

- Hardware support
 - Raspberry Pi AI HAT+ is sufficient for now
 - HALO will need to be switched to one of the Jetson alternatives in the future

REQUIREMENTS

- **Real-Time Data Processing:** HALO shall be able to process real-time data.
 - Model Inference
- **Object Detection Capabilities:** HALO shall be able to accurately detect orbital satellite objects.
 - Vision Transformer Utilization
- **Low-SWaP Deployability:** HALO shall be able to be deployed and run efficiently on low-SWaP devices.
 - Binary Quantization

DESIGN



TEST PLAN

- Test Items
 - Model Quantization Integrity
 - Detection Accuracy
 - Performance on Low-SWaP Hardware
 - System Reliability & Stability
 - Deployment & Configuration Testing

RISKS & MITIGATION

- Risks
 - Accuracy Degradation Due to Quantization
 - Performance Bottlenecks on Low-SWaP Hardware
 - Silent Failures
- Mitigation
 - Training to Recoup Losses in Accuracy
 - Code Optimization/Hardware Swap
 - System Health Monitoring

TERMINAL OUTPUT OF MODEL QUANTIZATION

```
(hailo_virtualenv) hailo@BlakesXPS:/local$ cd workspace/
(hailo_virtualenv) hailo@BlakesXPS:/local/workspace$ hailomz compile detr_resnet_v1_18_bn --hw-arch hailo8l --calib-path ../shared_with_docker/coco/calibration/
[info] No GPU chosen and no suitable GPU found, falling back to CPU.
<Hailo Model Zoo INFO> Start run for network detr_resnet_v1_18_bn ...
<Hailo Model Zoo INFO> Initializing the hailo8l runner...
[info] Translation started on ONNX model detr_resnet_v1_18_bn
[info] Restored ONNX model detr_resnet_v1_18_bn (completion time: 00:00:00.88)
[info] Extracted ONNXRuntime meta-data for Hailo model (completion time: 00:00:02.78)
[info] Start nodes mapped from original model: 'Concat_192': 'detr_resnet_v1_18_bn/input_layer1'.
[info] End nodes mapped from original model: 'Add_3451', 'Sigmoid_3460'.
[info] Translation completed on ONNX model detr_resnet_v1_18_bn (completion time: 00:00:07.75)
[info] Saved HAR to: /local/workspace/detr_resnet_v1_18_bn.har
<Hailo Model Zoo INFO> Preparing calibration data...
[info] Loading model script commands to detr_resnet_v1_18_bn from /local/workspace/hailo_model_zoo/hailo_model_zoo/cfg/all/generic/detr_resnet_v1_18_bn.all
[info] Found model with 3 input channels, using real RGB images for calibration instead of sampling random data.
[info] Starting Model Optimization
[warning] Running model optimization with zero level of optimization is not recommended for production use and might lead to suboptimal accuracy results
[info] Model received quantization params from the hn
[info] MatmulDecompose skipped
[info] Starting Mixed Precision
[info] Model Optimization Algorithm Mixed Precision is done (completion time is 00:00:01.98)
[info] LayerNorm Decomposition skipped
[info] Starting Statistics Collector
[info] Using dataset with 32 entries for calibration
Calibration: 100%|████████████████████████████████████████| 32/32 [02:25<00:00, 4.54s/entries]
[info] Model Optimization Algorithm Statistics Collector is done (completion time is 00:02:30.39)
[info] Starting Fix zp_comp Encoding
[info] Model Optimization Algorithm Fix zp_comp Encoding is done (completion time is 00:00:00.00)
[info] Starting Matmul Equalization
[info] Model Optimization Algorithm Matmul Equalization is done (completion time is 00:00:01.43)
[info] Starting MatmulDecomposeFix
[info] Model Optimization Algorithm MatmulDecomposeFix is done (completion time is 00:00:00.00)
[info] activation fitting started for detr_resnet_v1_18_bn/reduce_sum_softmax1/act_op
[info] activation fitting started for detr_resnet_v1_18_bn/reduce_sum_softmax2/act_op
[info] activation fitting started for detr_resnet_v1_18_bn/reduce_sum_softmax3/act_op
```


MILESTONE 2 TASK MATRIX

Task	Sloan
Literature Review	Research
4-bit Representation	Implement
Recoup Accuracy Losses	Post training



THANK YOU!
QUESTIONS?