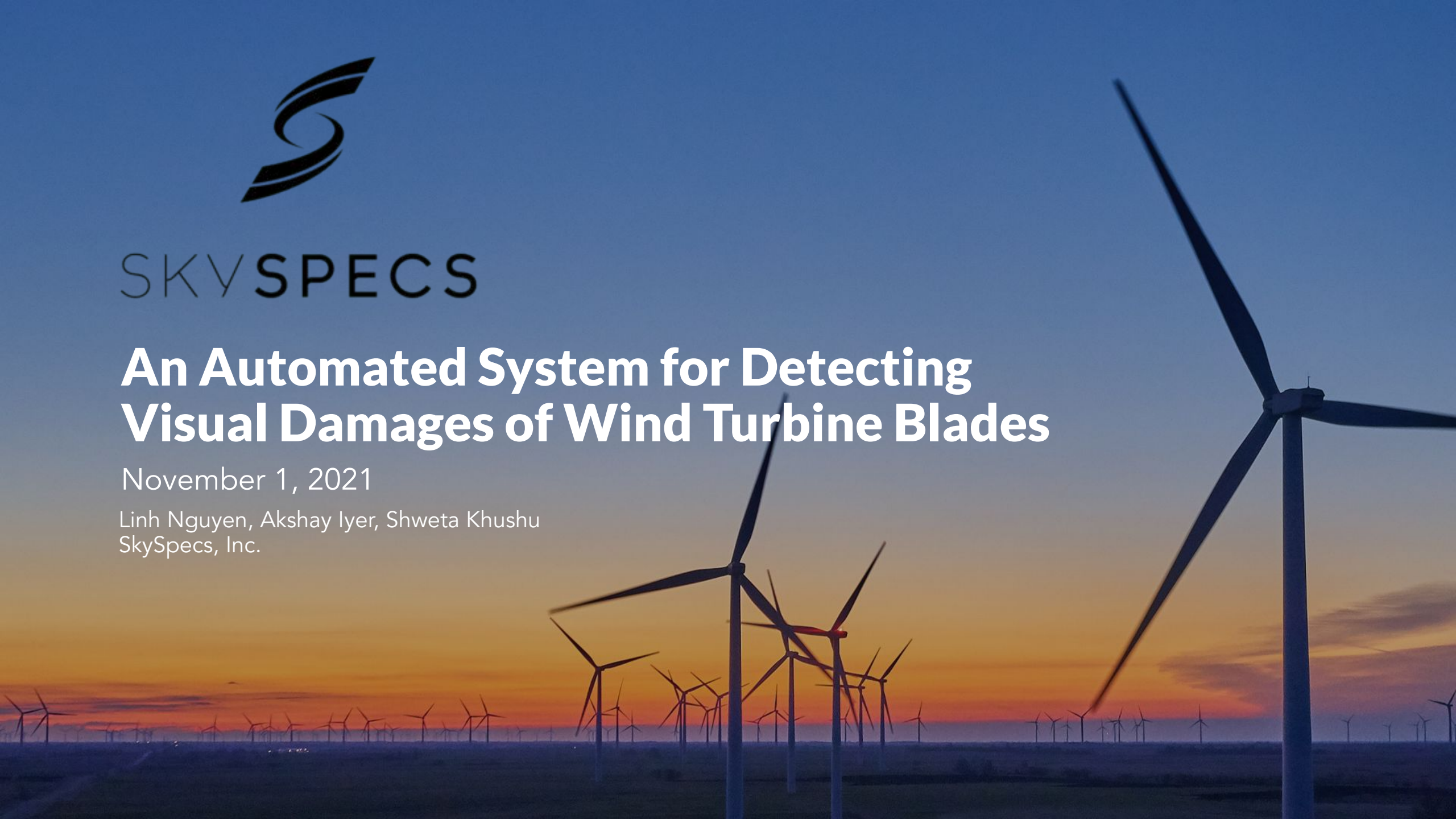

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An Automated System for Detecting Visual Damages of Wind Turbine Blades

November 1, 2021

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SkySpecs, Inc.

Motivation

- Wind has high maintenance cost compared to fossil fuels
- Blade damages account for the majority of failures, hence the high maintenance cost

If we can identify damages on blades early, wind can be competitive with fossil fuels on a market level

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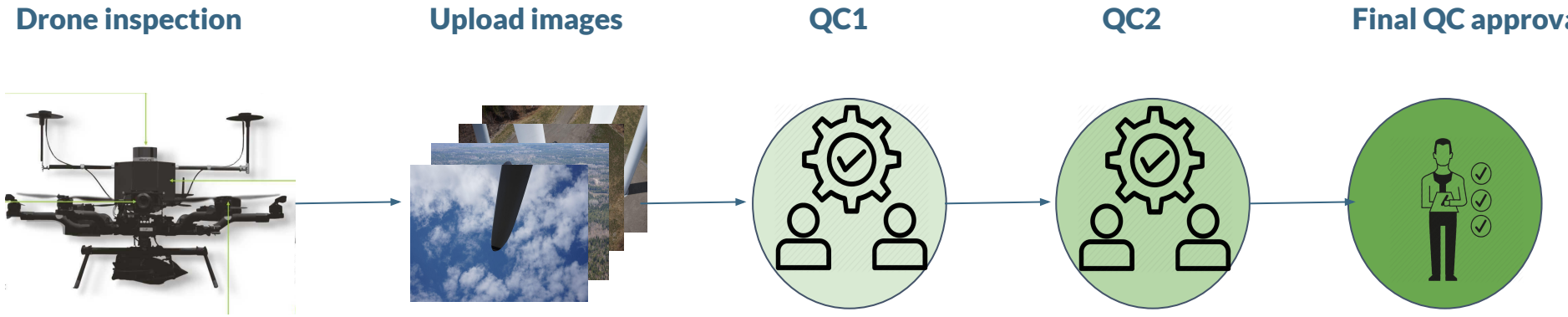
Motivation



- Miss fewer damages
- Lower time spent on QC1

Inspection Data

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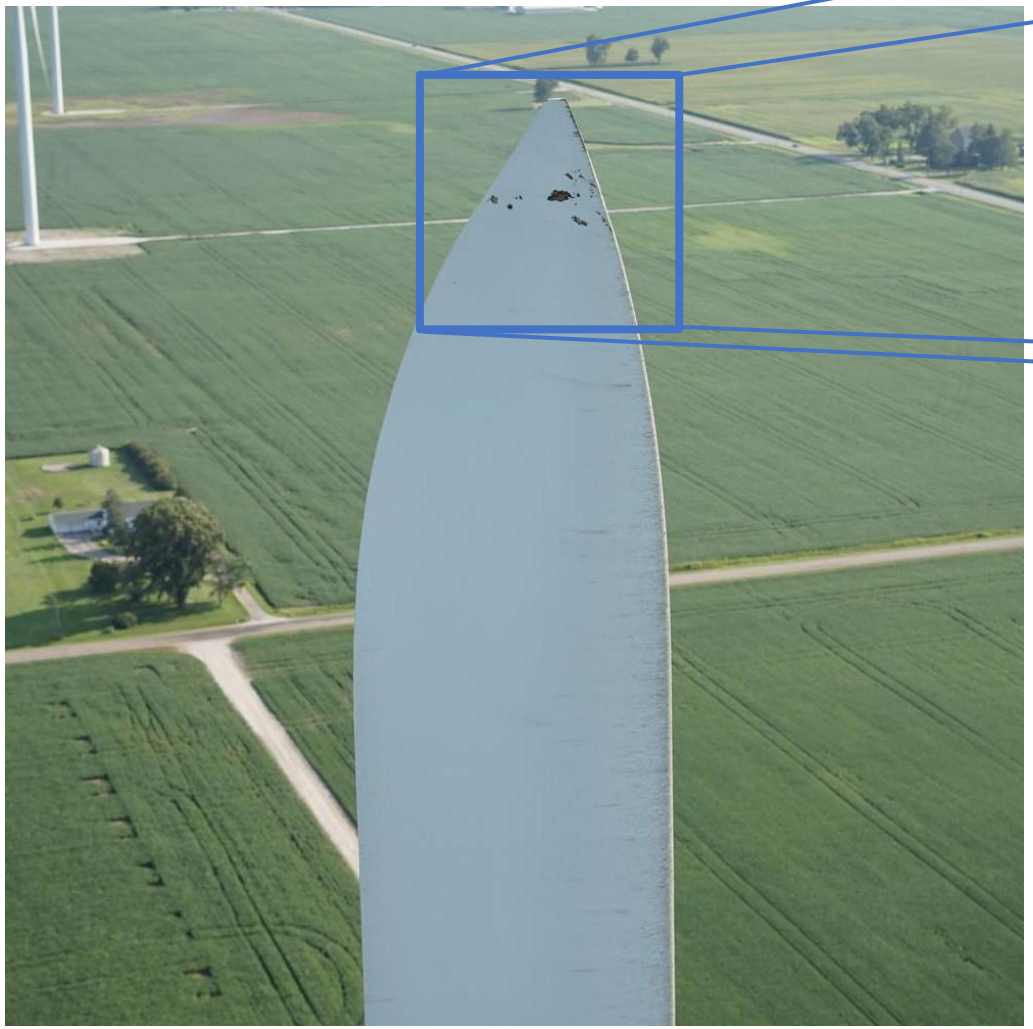
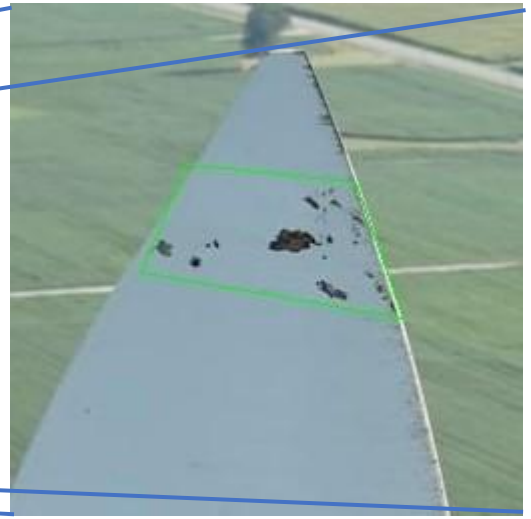
Where is the damage?





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Annotation

- Attractive candidate for detection
- Masks (green)
- Bounding box (red)

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Methods

Model:

- Mask RCNN-based

Data:

- 250000 inspection pictures
- 370000 annotations

Training:

- 80% train, 10% validation, 10% test

Hardware:

- EC2 instance with NVIDIA Tesla V100

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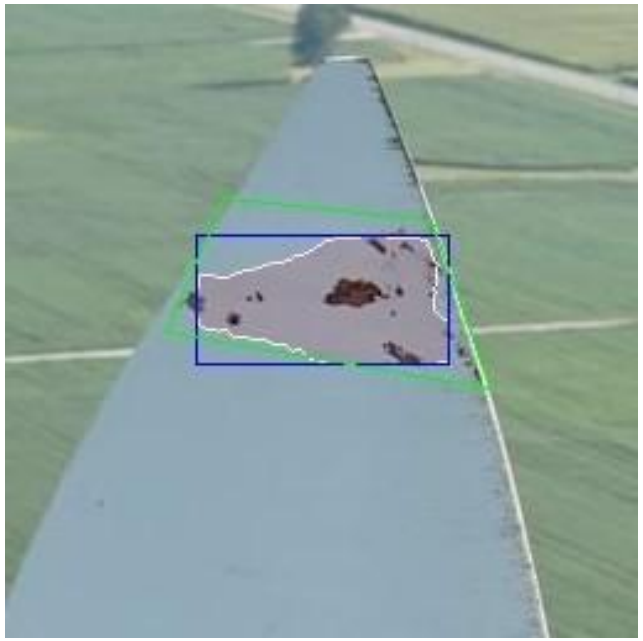
Training results

- Pixel-wise IOU is a poor metric
- Define damage recall and damage precision
  - Ground truth overlaps with one or more predictions by a certain threshold
  - Damage precision/recall at .4 and .93
- Predictions are *clues*



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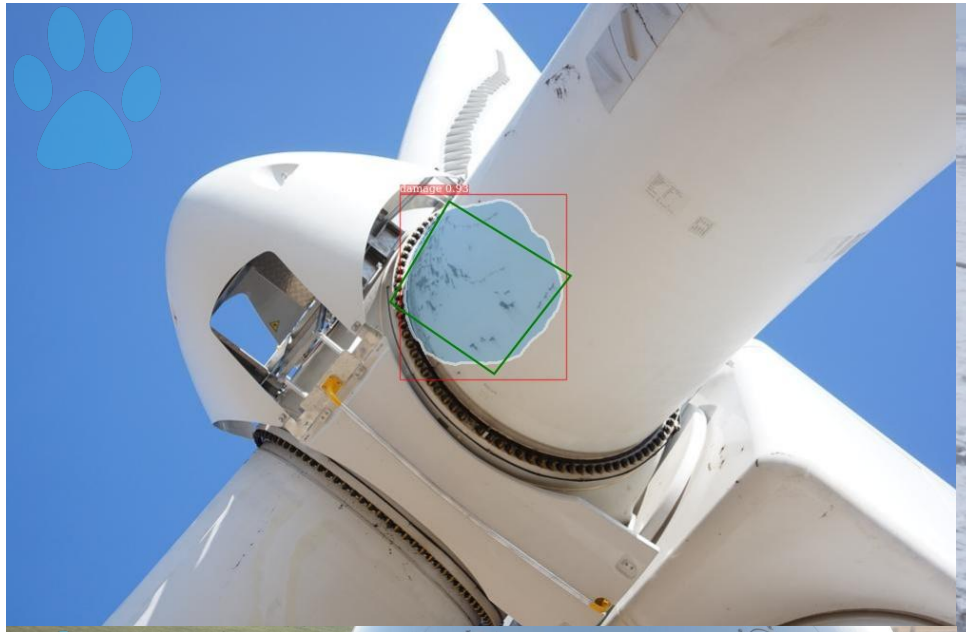

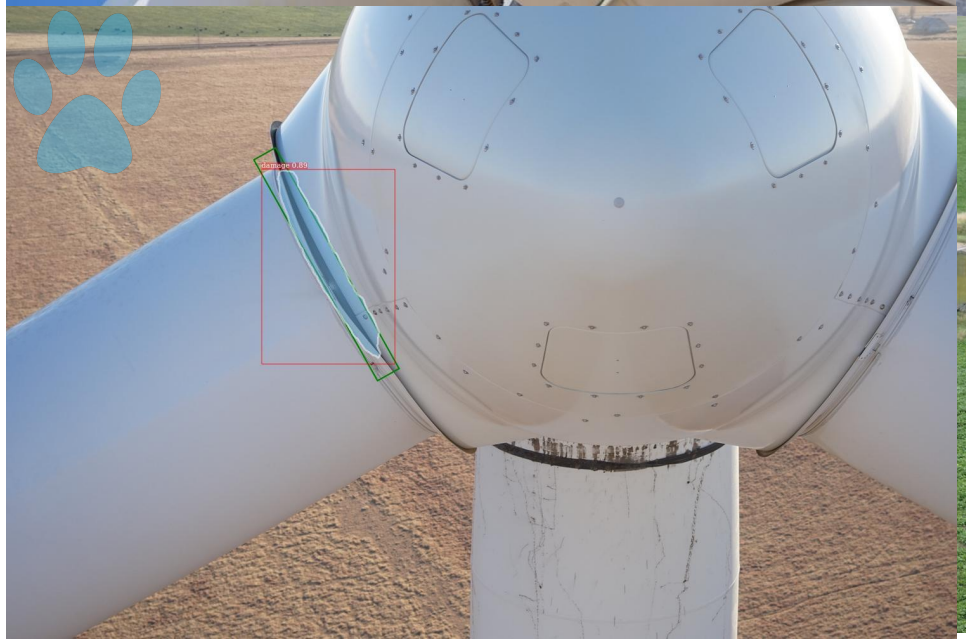

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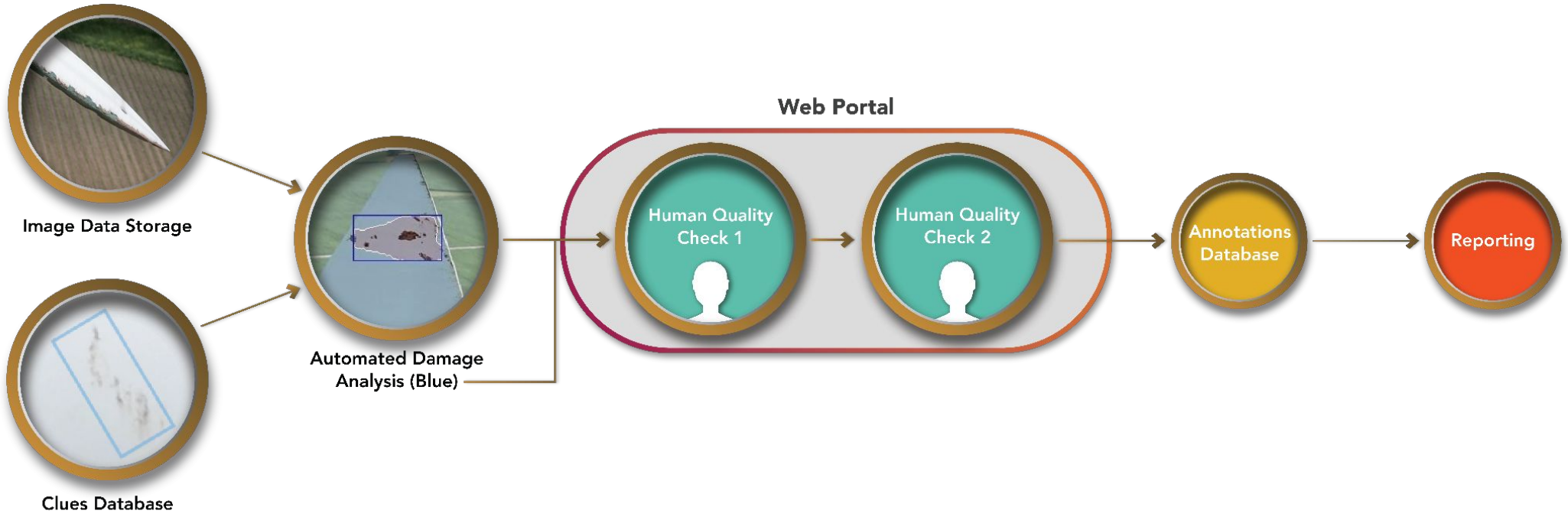
QC Process (cont'd)



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Results

Job No.	No. of annotations	No. of clues converted	% of clues converted
1	183	178	97.3%
2	192	184	95.8%
3	124	124	100%
4	192	184	95.8%
5	192	184	95.8%

Table 1: Percentage of the clues generated by Blue that were converted into actual annotations

Results

Clues Used (yes/no)	Average QC1 minutes (per picture)	Average QC2 minutes (per picture)	Average number of missed damages (per inspection)
no	0.212	0.090	0.0080
yes	0.205	0.086	0.0072

Table 2: Average time spent on QCs and number of misses in production

Conclusions and Future Work

Observations:

- Model can provide real world values even with poor ML metrics
- Scaling the model is easier than scaling a team of human analysts

Future Work:

- Train on segmented pictures
- Real time online inference

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(for a 100m rotor)

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