The background is a dark blue gradient with a subtle pattern of white dots. Overlaid on the left side are several concentric circles and arcs, some with degree markings (140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260) and arrows, suggesting a circular or orbital theme.

3. EXTRACTION OF ROAD AND LANE BOUNDARY FROM SATELLITE IMAGERY

DESHENG LIU, HONGHAO XU, YIFEI GE, XU TENG

PROCEDURE

1. Download aerial images according to GPS trajectory
2. For each image
 1. Detect edges
 2. Extract lines by Hough transformation
3. Remove invalid lines (based on distance from trajectory)
4. Use ML (line regression) to separate points into different lane groups
5. Convert coordinates from pixel-based to lat- and lon-based

GETTING IMAGE

- Getting image near all trajectory(automatically detected that the highest resolution is 19)
- Getting a big raw image for the whole path for the result analysis.

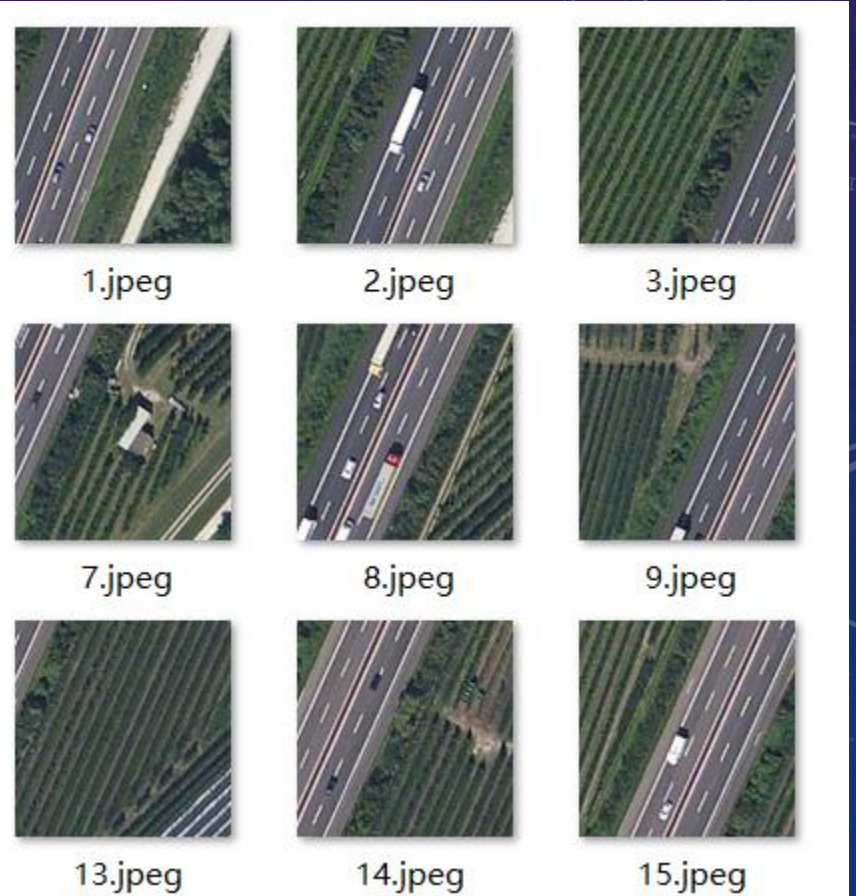
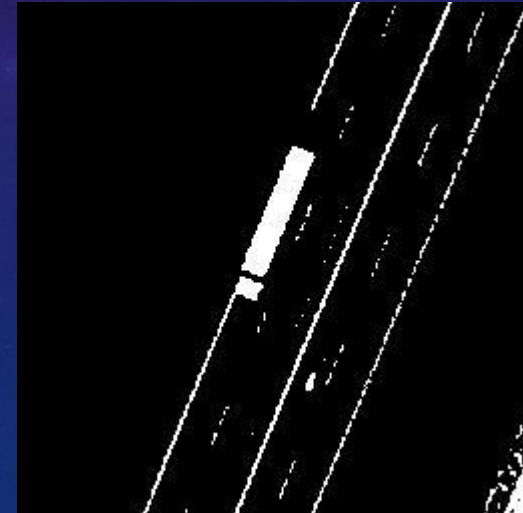


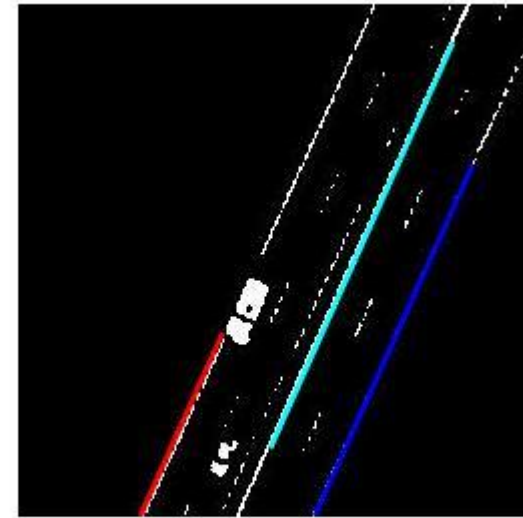
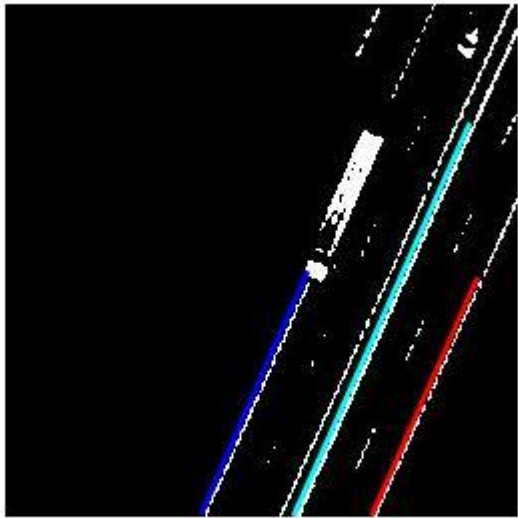
IMAGE PREPROCESSING

- Turn the image from rgb to gray, and filter the gray level to avoid the noise caused by the crop field nearby.

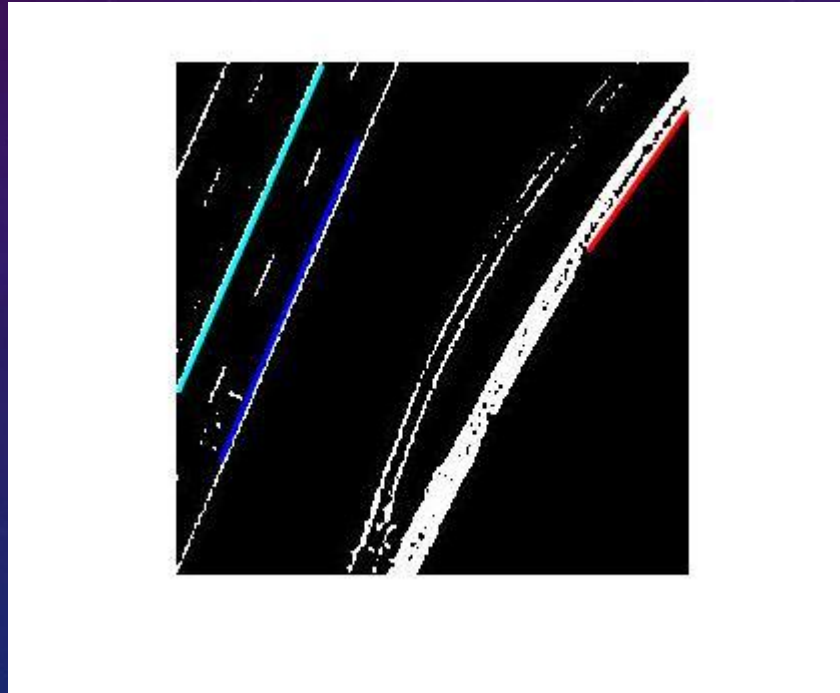


ALGORITHM DETAIL – EDGE DETECTION AND HOUGH TRANSFORMATION

- Using These method to get the longest three edge of each image.



ALGORITHM DETAIL – EDGE DETECTION AND HOUGH TRANSFORMATION



ALGORITHM DETAIL – LINE REGRESSION



ALGORITHM DETAIL – LINE REGRESSION

- Since the road is basically a line, so we used the linear regression method in machine learning.
- First we learned the Traj points and take the result as a standard result for the road.

ALGORITHM DETAIL - ION



ALGORITHM DETAIL – LINE REGRESSION

- Then we made a calculation and estimation. A lane is about five meter width, which equal about 34.5(two pixel extra boundary for the line width).
- We take all the start and end point we get from Hough and filter them with distance to standard line with the threshold (34.5 and 69).
- Points distance in 0-34.5 is regard as the right lane.
- Points distance in 34.5-69 and on the left of the standard lane regard as the left lane.

ALGORITHM DETAIL – LINE REGRESSION

- We take two more time linear regression for the point on the right lane and left lane to prove our method's correctness.

ALGORITHM DETAIL - ION



DECIDE ABOUT THE LANE BOUNDARY

- The leaned line is in the middle of each lane, and we use it to separate the left right boundary of the road and the mid of the road.
- Points on the right of the right lane line should be the right boundary. The same method used to get the mid and left.

RESULT



RESULT

- We calculate the points with the pixel coordinate back to the longitude and latitude, and saved them in three different csv data file for the mid of the road, left boundry and right boundry.

RESULT

46.395	11.296
46.396	11.297
46.396	11.296
46.398	11.298
46.398	11.298
46.399	11.298
46.398	11.298
46.4	11.299
46.399	11.299
46.401	11.3
46.4	11.299
46.402	11.3
46.401	11.3
46.402	11.301
46.402	11.3

46.396	11.296
46.397	11.297
46.396	11.297
46.397	11.297
46.397	11.297
46.398	11.298
46.397	11.297
46.399	11.298
46.399	11.298
46.4	11.299
46.399	11.298
46.4	11.299
46.4	11.299
46.4	11.299

46.396	11.296
46.401	11.299
46.401	11.299
46.401	11.3
46.401	11.299
46.403	11.301
46.403	11.301

Thank You

