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What is it?

A command-line utility that produces physically possible routes for a rover to take from point A to point B, navigating a provided elevation map with various algorithms

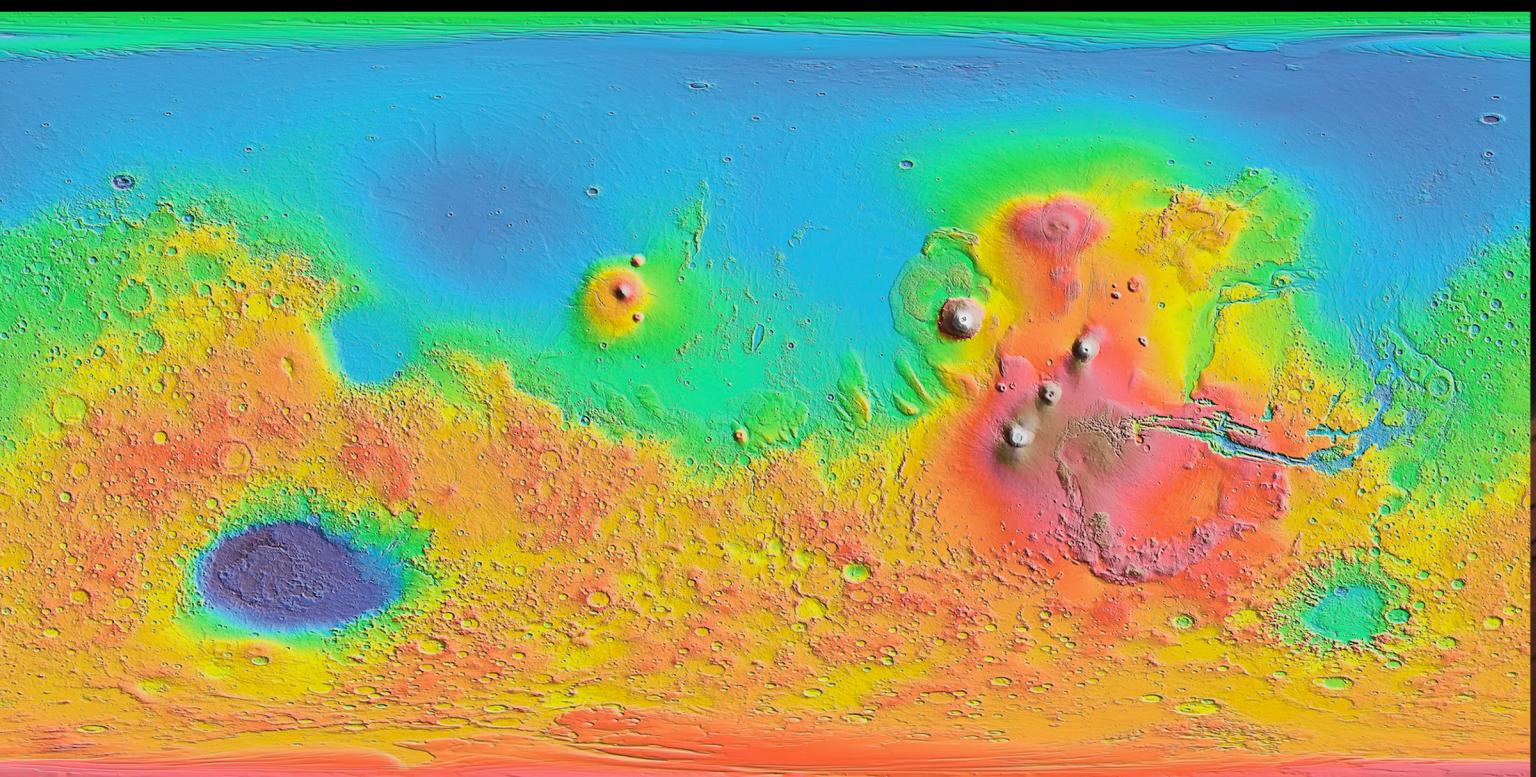


Figure 1: An elevation map of Mars

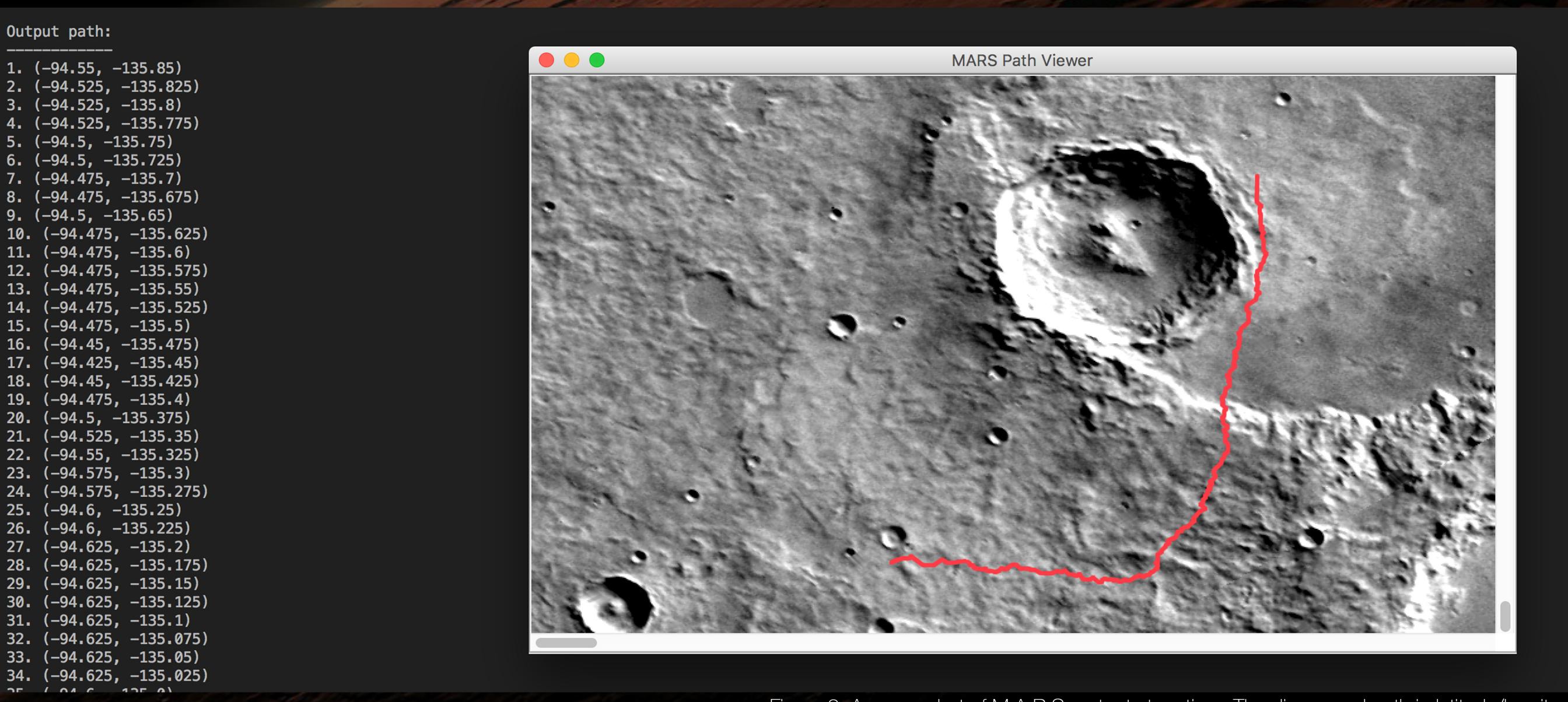


Figure 3: A screenshot of M.A.R.S. output at runtime. The discovered path in latitude/longitude coordinates is printed to the left, and the path is drawn in the map on the right

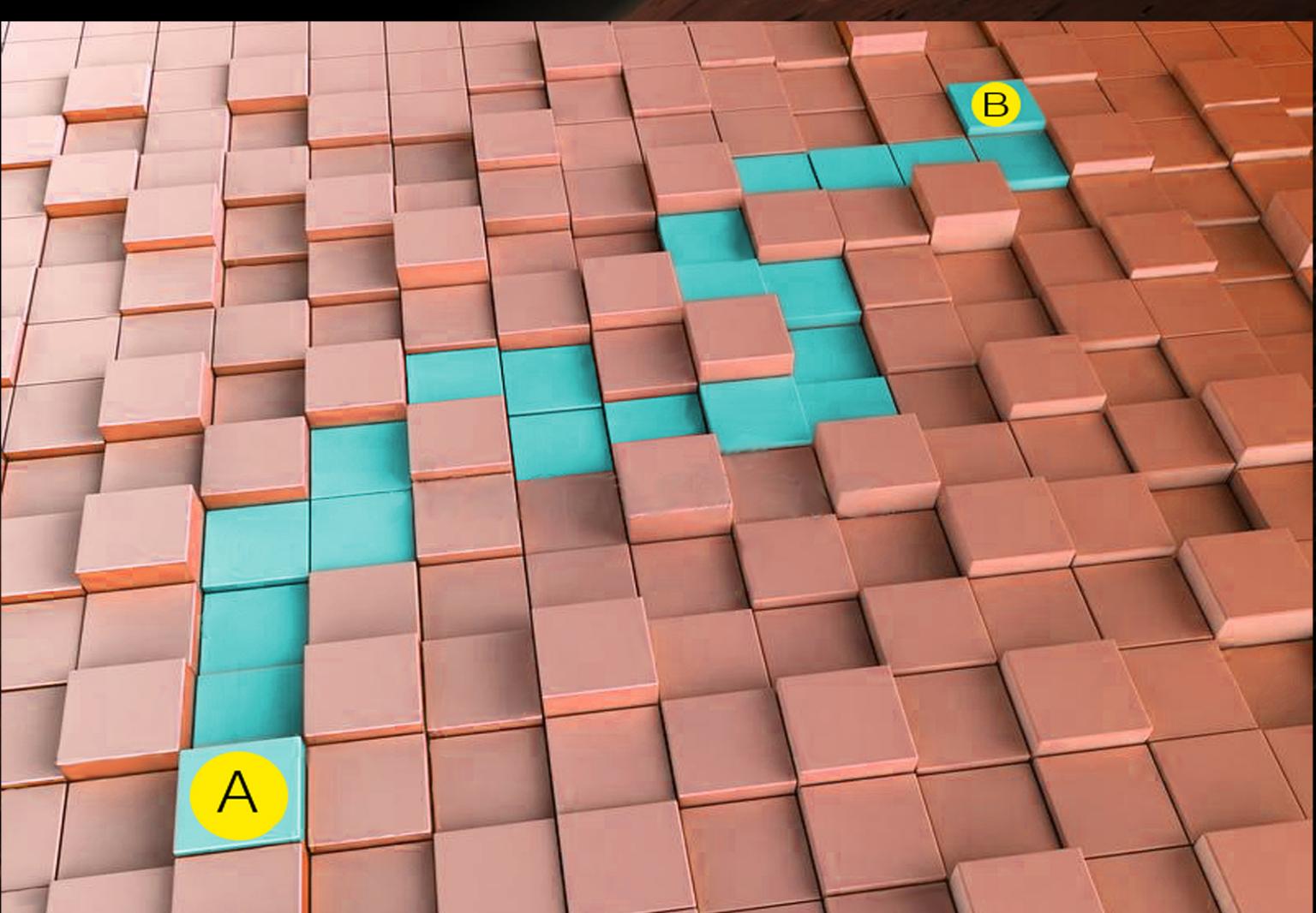


Figure 2: A simplified representation of how M.A.R.S. algorithms see elevation terrain

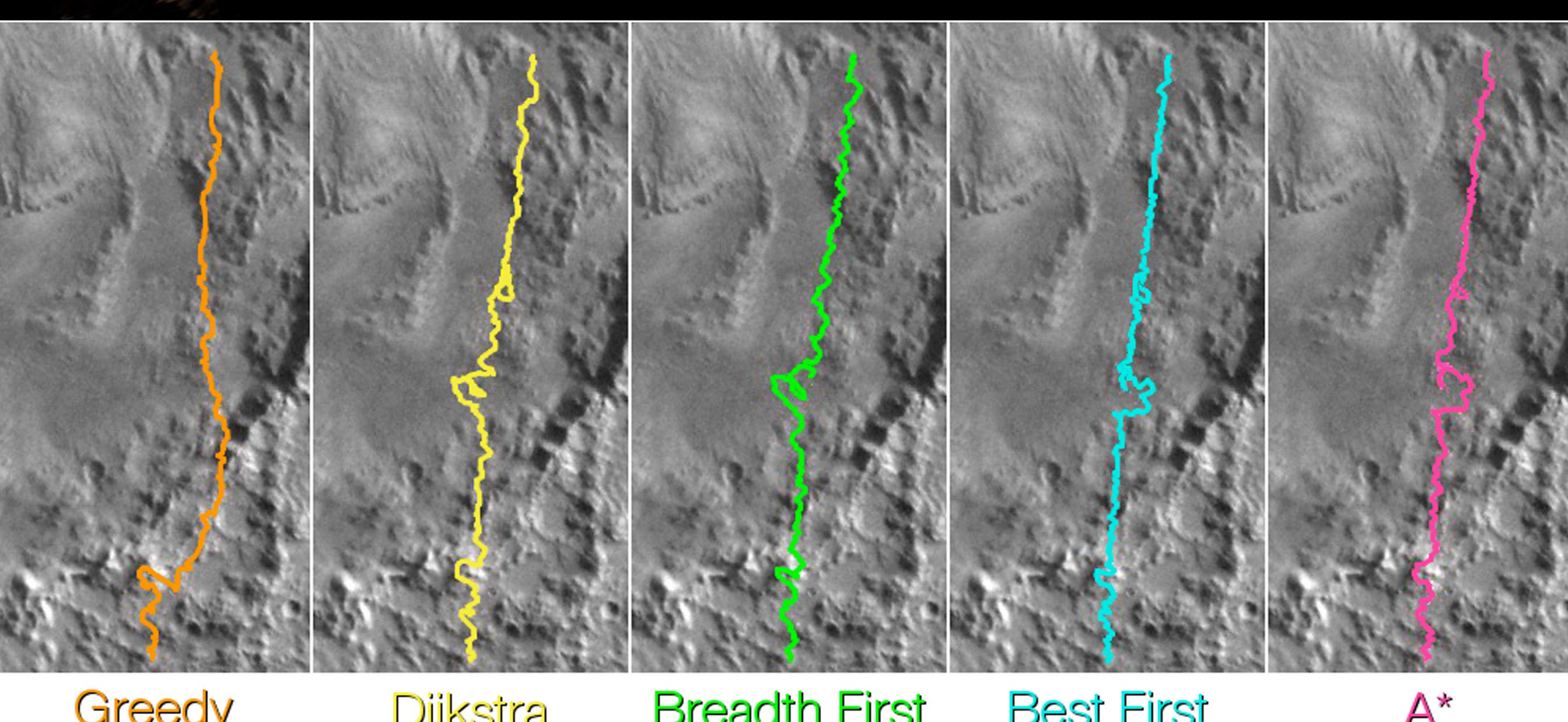


Figure 5: Paths discovered by the various algorithms implemented in M.A.R.S., all sharing the same start and end coordinates

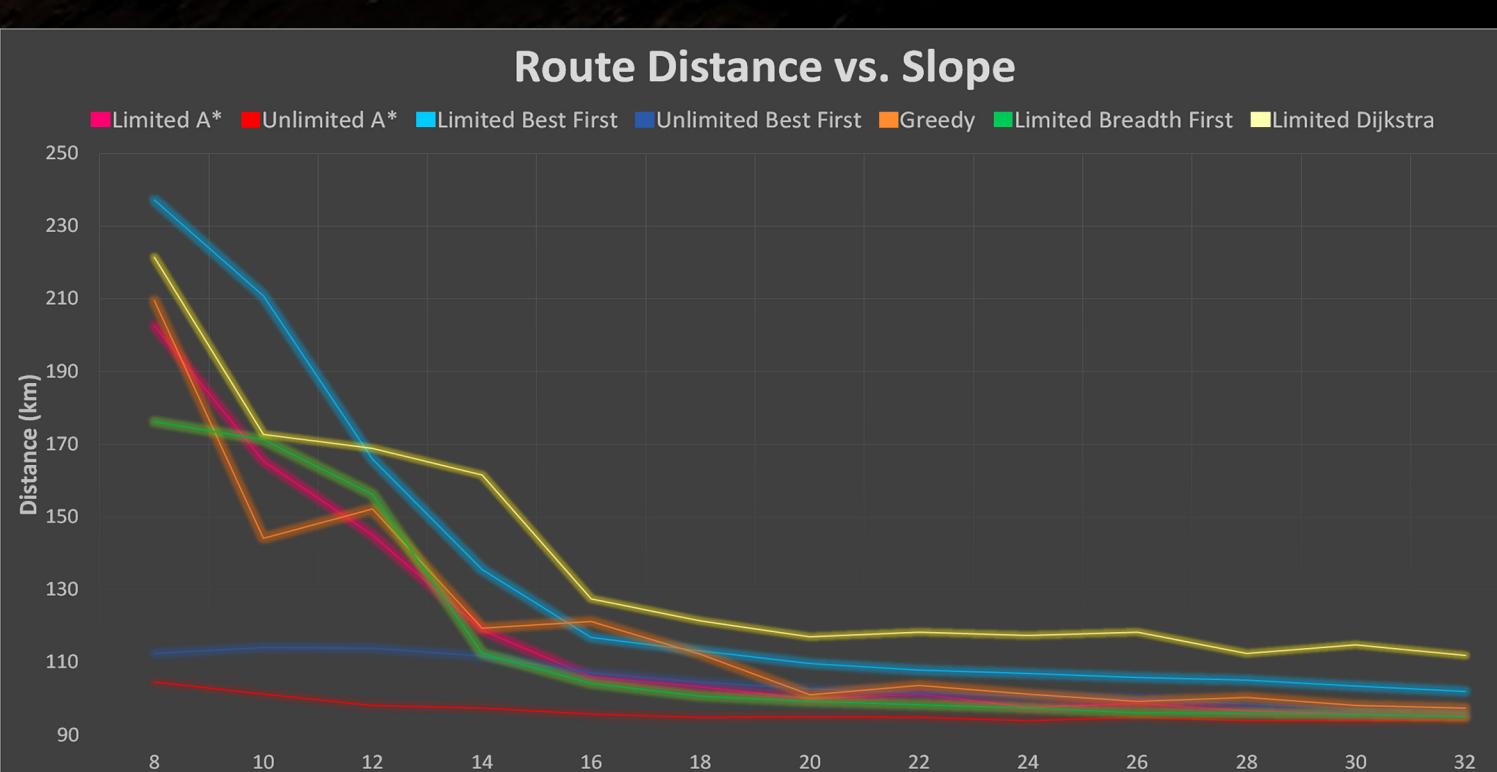


Figure 4: A plot of algorithm route sizes vs. slope allowance. As slope allowance goes up, route sizes generally shrink

Why was it needed?

- Determine landing site options for future rovers
- Confirm that paths exist from the landing site to the destination
- Simulate the mechanical wear-and-tear that different paths exert on the rover

Algorithms

- Unlimited* algorithms: full GeoTIFF (elevation map) is pre-loaded into the rover and ideal path is calculated up-front
- Limited* algorithms: the rover can only ‘see’ a certain distance away from itself, calculating more of the path as it moves

Limitations

- Our software can't handle large (>3GB) GeoTIFFs
- Route accuracy is partially determined by GeoTIFF ‘block’ size, or resolution of the GeoTIFF
- Doesn't account for different factors, such as soil type, weather, battery life

Problems Faced

- Circumventing Java’s memory & stack limitations
- Approximating terrain slope
- Implementing *limited* versions of the pathfinding algorithms

Next Steps

- Implement/fix the features in the Limitations section
- Elevation gain/loss tracking
- A full GUI interface



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