Journeys in the Sky: Visual Insights into Bird Migration
Research Questions

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1 Description of the dataset

Our dataset contains GPS-based movement records for three individually tracked seagulls: Eric, Nico, and Sanne. Each record includes geographic coordinates, altitude, estimated flight speed, and a timestamp, resulting in a detailed account of each bird's migratory behaviour over time.

Altitude and speed values help show how each bird flies, while the time information reveals how the migration progresses day by day. Periods of very low speed indicate when a bird is resting. Together, these variables allow for a straightforward analysis of where the birds travel, how they behave during the journey, and how their movement changes over time in an interactive visual setting.

Summary statistics:

- Total observations: 61,920
- Number of tracked birds: 3 (Eric, Nico, and Sanne)
- Sampling period: August 2013 onward
- Data collected: GPS coordinates, altitude, speed, and timestamps
- Resting periods: Identified through extended intervals of very low speed

2 Research Questions and Visualization Mapping

The following research questions were formulated to align with the structure of the dataset and the capabilities of the interactive dashboard. Each question is paired with a visualization designed to address it directly, to let the users explore the birds' migration from multiple perspectives.

2.1 RQ1: How do the migration trajectories differ among the tracked birds?

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Goal: To compare the overall spatial routes taken by the three birds.

Visualization: A static trajectory map showing complete paths for each bird and an animated movement map illustrating how the migration unfolds over time.

Notes: These visualizations highlight route divergence, migration extent, and geographic patterns.

2.2 RQ2: How do altitude, speed, and resting patterns vary across the birds?

Goal: To identify differences in behavioural characteristics.

Visualization: A comparative bar chart that displays maximum, average, and minimum altitude; maximum and average speed during flight; and the total number of detected resting periods.

Notes: This view supports a structured comparison of flight performance and behaviour across individuals.

2.3 RQ3: How do altitude and speed change over the course of each bird's journey?

Goal: To examine temporal patterns in flight behaviour.

Visualization: Animated line charts for altitude and speed, showing how these metrics evolve throughout the migration period.

Notes: These charts reveal long-term trends, periods of increased activity, and fluctuations in flight dynamics.

2.4 RQ4: How does migration activity change when represented as a time-based movement animation?

Goal: To explore the progression of migration events.

Visualization: An animated map that displays the birds' positions day by day, allowing users to observe travel pace.

Notes: This representation emphasizes the temporal flow of migration and differences in movement timing among the birds.

Initial Task Distribution

Diogo Os´orio Barroso

- Data preprocessing and cleaning
- Development of the interactive migration route map (RQ1)

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- Temperature–migration correlation visualisations
- Integration of geospatial layers

Bence Cs´oka

- Dashboard structure, layout, and architecture (Dash)
- Statistical visualizations (RQ2 - distance)
- State management between views

Katar´ına Safkov´a

- Statistical visualizations (RQ3 - altitude)
- Visual design, color palette, accessibility review
- Ensuring consistency across all chart elements

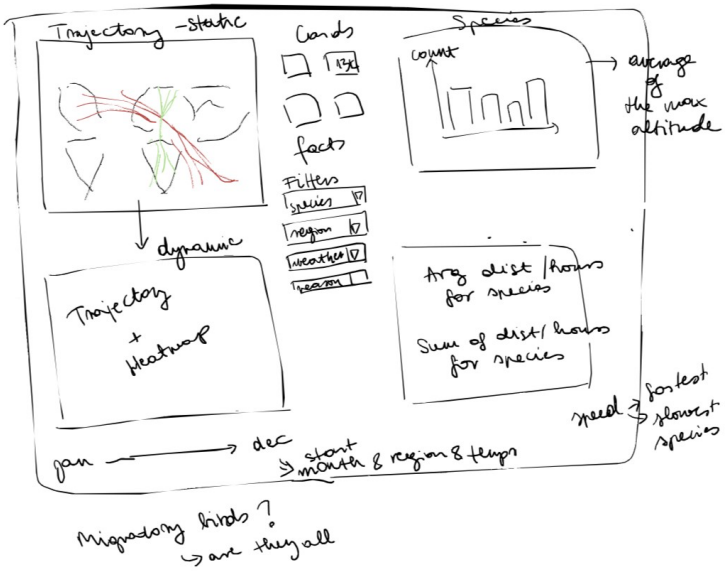
Szimona Szternak

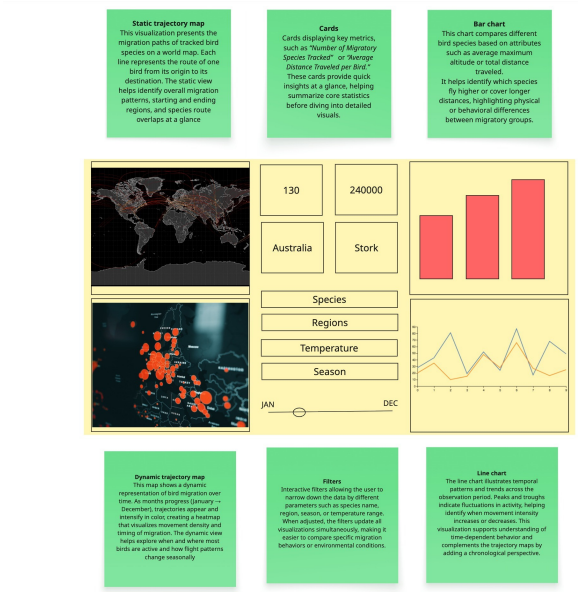
- Writing and refining the proposal and documentation
- Designing user interaction elements (filters, hover interactions)
- Seasonality views (RQ4 - heatmap)

Shared Tasks

- Final dashboard integration
- Testing and debugging across all views
- Final report and presentation

Initial sketches, drawings and ideas





These ideas reflect our initial interpretation of the dataset and our early assumptions about its potential. However, as we continue to work with the data and receive input from our instructors, our understanding and perspectives are already evolving. New insights gained during preprocessing, exploratory analysis, and feedback sessions are gradually reshaping our approach, encouraging us to refine our questions, adjust our visual strategies, and remain open to alternative analytical directions as the project develops.