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EDITORIAL

Reviews and Responses for
Fuel Burn Prediction from Open Flight Trajectory and Meteorological Data for the PRC Data Challenge 2025

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Reviewers: Quinten Goens and Allan Tart

Editor: Enrico Spinielli

1. Original paper

The DOI for the original paper is https://doi.org/10.59490/joas.2026.8766

2. Review - round 1

2.1 Reviewer 1

Review of "Fuel Burn Prediction from Open Flight Trajectory and Meteorological Data for the PRC Data Challenge 2025"

1 Introduction

This document is a review of the submission "Fuel Burn Prediction from Open Flight Trajectory and Meteorological Data for the PRC Data Challenge 2025" by Kačar and Ćulibrk, submitted to the Journal of Open Aviation Science (JOAS) as part of the EUROCONTROL PRC 2025 Data Challenge. The paper develops a segment-level fuel burn prediction system operating on open aviation data sources, combining ADS-B and ACARS trajectories, ERA5 pressure-level reanalysis, METAR surface observations, and FAA aircraft performance records. Physics-informed features are derived from the total energy balance with OpenAP-based drag and thrust models, and gradient boosting regressors (XGBoost and LightGBM) are trained on the resulting 73-feature representation with hyperparameters tuned via Optuna.

The review is organised as follows. Section 2 summarises the strengths of the submission. Section 3 lists potential issues identified in the manuscript. Section 4 raises questions and suggestions for further research. Section 5 lists minor textual issues. Line and section references correspond to the reviewed pre-print (v1).

2 Strengths

- **Physics-grounded mass estimation from the total energy balance.** Section 3.4 estimates aircraft mass by solving a quadratic derived from the total energy equation, with drag modelled as mass-dependent and thrust taken from OpenAP. Mass is constrained to lie between OEW and MTOW and is only computed on climb and descent points where the energy balance is well-conditioned. This avoids the need for an external take-off-weight prior and is a carefully engineered use of OpenAP for mass inference.

3 Potential issues

- **No explicit feature selection is discussed.** Section 3.5 only describes deterministic cleaning (missingness, single-value, identifier drops), and all 73 surviving features are passed to the model. Tree-based gradient boosters do perform implicit selection during training, so this is acceptable in principle, but with a heterogeneous feature set (kinematics, METAR, ERA5, FAA, OpenAP outputs) some redundancy is likely. A brief feature importance or correlation check would help confirm that the implicit selection works as expected on this feature set.

4 Questions and suggestions for further research

- **Explicit feature selection or importance analysis.** Adding a step such as feature importance ranking, correlation filtering, or recursive feature elimination would clarify which of the 73 inputs actually drive the prediction, reduce redundancy in the heterogeneous feature set, and improve interpretability of the final model.

5 Typographical and editorial remarks

- Page 1, line 20: "can achieve fuel estimation errors below 5The PRC Data Challenge 2025…", broken number/word boundary.
- Page 6, Section 3.3 heading: "Source-aware segment statistic" should be "statistics" (plural).
- Page 8, lines 162–165: variable definitions for the barometric formula are missing (the LaTeX symbols failed to render).
- Page 11, line 294: "Equation (??)", broken cross-reference.
- Page 13, Table 8 caption: "Table 8. TABLE VII. XGBoost Hyperparamaters", labels the table as "TABLE VII" while it is the eighth; "Hyperparamaters" should be "Hyperparameters".
- Page 14, Table 9 caption: "Table 9. TABLE IX. LightGBM Hyperparamaters", same misspelling.
- Page 14, line 343: "TAS typically exceeds CAS by 30–35Directions for further development include…", broken number/word boundary.
- Page 14, line 348: "the current pipeline generalities uniformly", likely "generalises uniformly".
- Page 12, Figure 1: axis and legend labels are very small and would benefit from regeneration at a larger font size.
- "modelling" vs "modeling", both forms appear.
- "behaviour" vs "behavior", both forms appear.
- All table captions are doubled in the form "Table N. TABLE N. …" (Tables 1–9).
- Several acronyms are used without being expanded at first use, including PRC, ASOS, ISA, FL, QAR, RBF, LSTM, CEEMDAN, DMPSO, and MAE. Additionally, several FAA database fields in Table 5 use acronyms (CWT, SRS, LAHSO, RECAT) without expansion in the description column.
- Some sentences are placed on their own line where this does not appear necessary (e.g. lines 116, 117, 144, 150). Merging these into the surrounding paragraphs would improve flow.
- Several URLs are embedded directly in the body text (e.g. lines 135, 139, 143). These would be better placed in the references list and cited from the text.
- Section 3.3 contains a series of bullet points for "mean and standard deviation of altitude / groundspeed / vertical rate / true airspeed". These could be combined into a single bullet to reduce repetition.

- The Conclusion (Section 5) is a single long paragraph. Splitting it into smaller paragraphs (e.g. results recap, limitations, future work) would improve readability.

2.2 Reviewer 2

For author and editor

This paper details a machine learning pipeline for the PRC Data Challenge 2025 that predicts segment-level aircraft fuel burn. The method is well described and as results demonstrate its robustness.

The paper would, however, benefit from the editing process.

1. **Expansion of abbreviations:** Abbreviations should be fully spelled out when first introduced.
2. **Proper referencing:** web resources and Python libraries should be formally cited rather than mentioned inline.

To further improve the readability, reviewer proposes adding more visual aids such as

(a) a plot of lateral flight path, highlighting the coverage differences between ADS-B and ACARS data,
(b) plot visualising the estimation results with the true values,
(c) standard ML visualisation like feature importance

3. Response - round 1

3.1 Response to reviewer 1

3.1.1 Comment 1

Explicit feature selection or importance analysis. Adding a step such as feature importance ranking, correlation filtering, or recursive feature elimination would clarify which of the 73 inputs actually drive the prediction, reduce redundancy in the heterogeneous feature set, and improve interpretability of the final model.

Response

Agreed. We included this conclusion in our Conclusion and Future Work section, which was unfortunately omitted by mistake in the generated PDF (see below).

3.1.2 Comment 2

Page 1, line 20: “can achieve fuel estimation errors below 5The PRC Data Challenge 2025…”, broken number/word boundary.

Response

We made a formatting error in LaTeX by leaving a unescaped % symbol, which caused the remaining text in that paragraph to be treated as a comment and excluded from the PDF. The intended text has now been properly restored in the updated PDF.

3.1.3 Comment 3

Page 6, Section 3.3 heading: “Source-aware segment statistic” should be “statistics” (plural).

Response

Corrected.

3.1.4 Comment 4

Page 8, lines 162–165: variable definitions for the barometric formula are missing (the LaTeX symbols failed to render).

Response

Corrected.

3.1.5 Comment 5

Page 11, line 294: “Equation (??)”, broken cross-reference.

Response

Corrected.

3.1.6 Comment 6

Page 13, Table 8 caption: “Table 8. TABLE VII. XGBoost Hyperparamaters”, labels the table as “TABLE VII” while it is the eighth; “Hyperparamaters” should be “Hyperparameters”.

Response

Corrected.

3.1.7 Comment 7

Page 14, Table 9 caption: “Table 9. TABLE IX. LightGBM Hyperparamaters”, same misspelling.

Response

Corrected.

3.1.8 Comment 8

Page 14, line 343: “TAS typically exceeds CAS by 30–35Directions for further development include…”, broken number/word boundary.

Response

This was the same LaTeX formatting error involving an unescaped % symbol. The complete text has now been restored in the PDF, including the discussion on feature importance analysis and Shapley value decomposition.

3.1.9 Comment 9

Page 14, line 348: “the current pipeline generalities uniformly”, likely “generalises uniformly”.

Response

Corrected.

3.1.10 Comment 10

Page 12, Figure 1: axis and legend labels are very small and would benefit from regeneration at a larger font size.

Response

Corrected.

3.1.11 Comment 11

“modelling” vs “modeling”, both forms appear.

Response

Corrected.

3.1.12 Comment 12

“behaviour” vs “behavior”, both forms appear.

Response

Corrected.

3.1.13 Comment 13

All table captions are doubled in the form “Table N. TABLE N. …” (Tables 1–9).

Response

Corrected. Additionally, the table references in the manuscript have been changed from Roman to Arabic numerals.

3.1.14 Comment 14

Several acronyms are used without being expanded at first use, including PRC, ASOS, ISA, FL, QAR, RBF, LSTM, CEEMDAN, DMPSO, and MAE. Additionally, several FAA database fields in Table 5 use acronyms (CWT, SRS, LAHSO, RECAT) without expansion in the description column.

Response

Corrected.

3.1.15 Comment 15

Some sentences are placed on their own line where this does not appear necessary (e.g. lines 116, 117, 144, 150). Merging these into the surrounding paragraphs would improve flow.

Response

Corrected. This discrepancy was caused by LaTeX automatically placing the tables in different positions than originally planned. We have slightly adjusted the sentences and moved the tables to ensure correct placement.

3.1.16 Comment 16

Several URLs are embedded directly in the body text (e.g. lines 135, 139, 143). These would be better placed in the references list and cited from the text.

Response

Corrected.

3.1.17 Comment 17

Section 3.3 contains a series of bullet points for "mean and standard deviation of altitude / groundspeed / vertical rate / true airspeed". These could be combined into a single bullet to reduce repetition.

Response

Corrected.

3.1.18 Comment 18

The Conclusion (Section 5) is a single long paragraph. Splitting it into smaller paragraphs (e.g. results recap, limitations, future work) would improve readability.

Response

Corrected.

3.1.19 Additional change

Response

We noted that a section title was missing: "3.3 Trajectory coverage and segment extraction". This title has now been inserted at line 153 of the original manuscript. Additionally, all references to section titles throughout the paper have been corrected.

3.2 Response to reviewer 2

3.2.1 Comment 1

Expansion of abbreviations: Abbreviations should be fully spelled out when first introduced.

Response

Corrected.

3.2.2 Comment 2

Proper referencing: web resources and Python libraries should be formally cited rather than mentioned inline.

Response

Corrected.

3.2.3 Comment 3(a)

To further improve the readability, reviewer proposes adding more visual aids such as a plot of lateral flight path, highlighting the coverage differences between ADS-B and ACARS data.

Response

A plot of the flight has been added as Figure 1. Accompanying text has also been added at line 132.

3.2.4 Comment 3(b)

Plot visualising the estimation results with the true values.

Response

In Section 4 (Results), we have added Figure 5 and the accompanying text. We performed out-of-fold (OOF) predictions on the cross-validation (CV) folds of the training dataset, since the final test dataset has hidden target values.

3.2.5 Comment 3(c)

Standard ML visualisation like feature importance.

Response

In Section 4 (Results), we have added Figures 3 and 4 along with the accompanying text. We present both the Gain and Split feature importances from our LightGBM model.