**I-GUIDE MODEL CARD**

The I-GUIDE Model Card is an easy-to-use tool that will allow you to create documentation for each model that you create or use in a project.

Using this tool will help facilitate transparency and reproducibility about your project. It will also help you comply with relevant policies of journals, funding agencies, and universities.

The Model Card applies to:

* Pre-existing models acquired from other sources, e.g., produced by other researchers;
* Models you and your collaborators produced yourselves;
* Models you and your collaborators produced by integrating two or more other models (e.g., coupling).

**Model Card Attribution**

This Model Card template is an adapted version of the I-GUIDE Data Card template, which itself is based on Google’s *Data Cards Playbook* (https://pair-code.github.io/datacardsplaybook/).  
It has been restructured to address key considerations for geospatial model transparency, performance evaluation, and ethical deployment, in alignment with the I-GUIDE research lifecycle.

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AI-generated content may be incorrect.

* + 1. **BASIC INFORMATION**

|  |  |
| --- | --- |
| Model Card ID Number | *LFMC\_ML-01* |
| Model Name | *Live Fuel Moisture Content (LFMC) Prediction with Daymet & SOLUS Using Machine Learning* |
| Model Version | *1* |
| Persistent Identifier | *N/A* |
| Outputs Supported | *N/A* |
| Model Card Author | *Ehsan Foroumandi, The University of Alabama, eforoumandi@crimson.ua.edu* |

* + 1. **MODEL OVERVIEW**

|  |  |
| --- | --- |
| Model Type | *(Select all that apply)*  ☐ AI model: *Neural Networks*  ☐ Statistical model: *(Specify type)*  ☐ Other: *(Specify)* |
| Purposes | *(Select all that apply)*  ☐ Classification  ☐ Decision support  ☐ Forecasting  ☐ Regression  ☐ Simulation  ☐ Spatial analysis  ☐ Other: *(Specify)* |
| Domains of Application | *(Select all that apply)*  ☐ Climate science  ☐ Economics  ☐ Environmental impact modeling  ☐ Geospatial analysis  ☐ Hydrology  ☐ Population modeling  ☐ Other social systems modeling: *(Specify)*  ☐ Other: *(Specify)* |
| Model Authors and Developers | Contributors:  Ehsan Foroumandi  Lance Legel |
| Source and Acquisition Method | ☐ Acquired (from external source)  ☐ Developed internally  ☐ Integrated from multiple models (e.g., coupled) |
| User Licensing | ☐ Open source: *(Specify license type)*  ☐ Proprietary: *(Specify owner)*  ☐ Other restrictions on use: *(Specify restrictions)* |
| Storage Location | ☐ Repository: *(Name and link to dataset)*  ☐ Project-specific storage: *(Describe location)* |
| Access Control Policies | ☐ Open  ☐ Embargoed: *(Describe release timeline)*  ☐ Restricted: *(Describe access criteria)* |
| Use Case | *Train a deep neural network regressor on engineered spatial features to predict LFMC.* |

* + 1. **MODEL INPUTS AND TRAINING DATA**

|  |  |
| --- | --- |
| Model Inputs | * + [*Daymet*](Thornton,%20M.%20M.,%20Shrestha,%20R.,%20Wei,%20Y.,%20Thornton,%20P.%20E.,%20&%20Kao,%20S.-C.%20(2022).%20Daymet:%20Daily%20Surface%20Weather%20Data%20on%20a%201-km%20Grid%20for%20North%20America,%20Version%204%20R1%20(Version%204.1).%20ORNL%20Distributed%20Active%20Archive%20Center.%20https:/doi.org/10.3334/ORNLDAAC/2129%20Date%20Accessed:%202025-08-25)   + [*SOLUS100*](https://doi.org/10.1002/saj2.20769) |
| Input Data Types | *(Select all that apply)*  ☐ Raster  ☐ Tabular  ☐ Time Series  ☐ Vector  ☐ Other: *(Specify)* |
| Training Data Used | * *Target: LFMC* * *Inputs: Same as ‘*Model Inputs’ |
| Training Dataset Representativeness | *The target data are limited and consist of point observations collected at different times.* |

* + 1. **MODEL STRUCTURES**

|  |  |
| --- | --- |
| Feature Selection | *All the input data have been utilized.* |
| Hyperparameters and Tuning | *Number of hidden layers*  *Number of neurons in each layer*  *Dropout*  *Learning Rate* |
| Software and Dependencies | *Python;*  *Libraries:*  *numpy*  *pandas*  *scikit-learn*  *tensorflow* |

* + 1. **MODEL PERFORMANCE AND EVALUATION**

|  |  |
| --- | --- |
| Validation Approach | ☐ Cross-validation  ☐ Holdout set  ☐ Time series split  ☐ Other: *(Specify)* |
| Evaluation Results | *Final Test Set Performance:*  *NSE=0.408*  *RMSE=33.156*  *R2=0.640* |
| Testing or Validation Data Used | *Derived from the same combined features* |
| *(If model is integrated from multiple other models)*  Contribution of Constituent Models | *N/A* |

* + 1. **MODEL ADAPTATION AND CUSTOMIZATION (for acquired or integrated models only)**

|  |  |
| --- | --- |
| Source Models | *N/A* |
| Availability of Source Model Code | *N/A* |
| Modifications | *N/A* |
| Training Data Adjustments | *N/A* |

* + 1. **MODEL DEPLOYMENT AND USAGE**

|  |  |
| --- | --- |
| Computational Requirements | *(List hardware/software requirements)* |
| Geospatial Considerations | *The target data are limited and consist of point observations collected at different times.* |

* + 1. **TRANSPARENCY, EXPLAINABILITY, AND INTERPRETABILITY**

|  |  |
| --- | --- |
| Model Transparency | ☐ Fully transparent (rule-based, interpretable ML)  ☐ Partially transparent (some explainability features)  ☐ Black box (deep learning, complex ML models) |
| Explainability Features | ☐ Feature importance analysis  ☐ LIME  ☐ Sensitivity analysis  ☐ SHAP values  ☐ Other: *(Specify)* |
| Interpretability Challenges | *Nonlinear feature interactions can make local reasoning difficult.* |
| Communication of Model Limitations | *Uncertainty quantification has not been included.* |

* + 1. **OTHER ETHICAL CONSIDERATIONS**

|  |  |
| --- | --- |
| Ethical Risks (Other Than Transparency, Explainability and Interpretability) | *(Select all that apply)*  ☐ Bias in training data: *(Specify)*  ☐ Intentional misuse risks: *(Specify)*  ☐ Privacy risks and surveillance: *(Specify)*  ☐ Security risks: *(Specify)*  ☐ Stigmatization of individuals or communities: *(Specify)*  ☐ Other: *(Specify)* |
| Measures Taken to Address Ethical Risks | *The dataset was systematically split, and the test and validation sets were standardized using the statistical properties of the training data to prevent data leakage* |
| Suitable Uses | *Decision support and exploratory analysis.* |
| Unsuitable Uses | *Sensitive decision making.* |