AI System review:

The Department of Technology is overseeing the Central Transit Signal Priority project, which provides signal priority for VTA bus routes 66 & 68 for all intersections along the route within City of San José jurisdiction. Transit signal priority gives buses priority at an intersection and creates less idle time waiting for a green light. Ultimately, the goal is to reduce travel time and alleviate traffic congestion.

The project uses the "LYT.transit" system to implement transit signal priority. The LYT.transit system tracks transit vehicles in real-time and communicates with downstream intersections to optimize signal timing, reducing transit vehicle travel time. It is built using a supervised machine learning model. A study done on a pilot project in San Jose during 2019 demonstrated that the LYT.transit system may reduce travel times by more than 15%.

The LYT.transit system performs best when the vehicle position data is highly accurate and frequently updated. Performance of the system will likely be poorer if a vehicle's GPS equipment loses accuracy over time or there is poor cellular communication between onboard vehicle equipment and the transit agency data center. The primary consequence of poor performance is lengthier travel times and traffic congestion.

Since the LYT.transit system predicts bus arrival time based on GPS data, there is relatively minimal human bias in the training data. The effectiveness of the system can be measured by comparing the travel time before implementing LYT.transit to the travel time using LYT.transit. With a new software update from LYT.ai expected in 2023, City staff will be able to see this performance metric in real-time.

Given the demonstrated reduction in travel times, minimal bias of the training data, and ability to view real-time performance metrics, this AI system is approved for usage in the City. The City should continue to monitor the effectiveness of the system as defined by bus travel time before and after LYT.transit implementation. If the system continues to show benefit, the City should explore applying the project to other routes.

Vendor FactSheet for Algorithmic Systems

Please provide details regarding your algorithmic system product by filling out the FactSheet[1] template and Algorithmic Impact Assessment Questionnaire below. You can find an example of a completed FactSheet on page 3.

FactSheet

Vendor Name	Sinwaves Inc. d/b/a LYT
Model Name	Transit vehicle ETA estimator
Overview	The LYT.transit system tracks transit vehicles in real-time and communicates with downstream intersections to optimize signal timing, reducing transit vehicle travel time.
Purpose	This model generates the estimated time of arrival of a transit vehicle at intersections along its route.
Intended Domain	Transportation / transit
Training Data	The model is trained on transit vehicle location, route, and schedule adherence data.
Model Information	The model is a supervised machine learning model, specifically a regression model.
Inputs and Outputs	Inputs: vehicle position, speed, route, schedule adherence Outputs: array of estimated time of arrivals in seconds to the upcoming intersections
Performance Metrics	MAE (mean absolute error) of predicted ETA against test data is used to evaluate the model. Model is trained on a weekly basis as new vehicle data is gathered from deployed transit vehicles.
Optimal Conditions	• High accuracy of vehicle position data

[1] The FactSheet template is heavily inspired by the IBM Research AI FactSheets 360 project.

	• Frequent updates of vehicle data
Poor Conditions	• GPS drift in vehicle GPS equipment • Poor cellular communication between onboard vehicle equipment and transit agency data center
Bias	Since this is a model that predicts times of arrival for buses based on GPS updates and other geospatial and timing information, many of the problems of human bias in training data do not enter into this model's operation. The training set consists of all bus trajectories (within some time window) for exactly those routes upon which the model will be operating during live inference.
Test Data	The model is tested against past transit vehicle position and schedule adherence data.

Algorithmic Impact Assessment Questionnaire

Accuracy	
Under what conditions/circumstances has the system been tested?	The LYT.transit system has been tested internally with a corpus of past transit vehicle trajectory data as well as on the field, by intersection and by route.
Have the vendors or an independent party conducted and published a validation report (including the methodology and results) that audits for accuracy and discriminatory/disparate impact? If yes, can the City review the study?	Yes. LYT has published a report on the first deployment of the technology here: https://mailchi.mp/07b1e3eba2b4/llgp2f8piv
Will the model be learning from the information it gets in the field during deployment?	Yes. LYT collects real-time vehicle data from transit vehicles and uses it to iteratively retrain its ETA prediction models.
Equity	
What quality control is in place to test and monitor for potential biases in the AI system (e.g., non-representative training data, overfitting, hard-coded rules)?	It is known in advance on which routes LYT's model will operate. Accordingly, only relevant trips can be selected for training data. Additionally, training data is preprocessed to remove outlier trips. Model testing is conducted against data that occurred after the training data in order to protect against time leakage in evaluating model performance.

How can the City and its partners flag issues related to bias, discrimination or poor performance of the AI system?	LYT.transit provides a web portal to each customer to show the results of the LYT.transit system and its impact on transit performance in the form of reports and graphs.
Explainability	
What performance metrics were selected to judge the model's effectiveness? What is it optimizing for, and under what constraints?	Mean average error is the primary metric for ETA model evaluation. The model is optimizing for minimal error between its predicted time of arrival and the true time of arrival.
How are the outcomes of the AI system explained to subject matter experts, users, impacted individuals, or others?	The LYT.transit system directly impacts transit route performance, which can be measured in terms of on-time performance using the transit agency's existing performance monitoring systems or LYT's web portal.

Example: FactSheet[2]

Vendor Name	XYZ Technologies, Inc.
Model Name	Image Caption Generator
Overview	This document is a FactSheet accompanying the Image Caption Generation model on IBM Developer Model Asset eXchange.
Purpose	This model generates captions from a fixed vocabulary that describe the contents of images.
Intended Domain	Computer Vision
Training Data	The model is trained on the COCO dataset.
Model Information	The model, named Show and Tell, is based on an encoder-decoder pattern.
Inputs and Outputs	Input: An image. Output: Description of the image

[2] The example FactSheet is taken from IBM Research AI Factsheet 360's Image Caption Generator sample.

Performance Metrics	Model is assessed based on human assessment of the quality of the caption matched to the image (scored 0-5). The average score for captions reviewed by humans in 2021 was 3.7, with a standard deviation of 0.3. 95% of captions were scored between 3.1 and 4.3.
Optimal Conditions	● Model works well for inputs similar to the training dataset. ● Images have good resolution and lighting.
Poor Conditions	● Images have poor resolution or lighting. ● The input is from a different distribution than what the model is trained on. ● The model is not trained for a specific class.
Bias	The Image Caption Generator was evaluated for bias for Male gender as against Female gender using the AIF360 toolkit. From the evaluations it was found that the model is 42.1% more biased towards generating male-specific caption words in images than female-specific gender caption words.
Test Data	Test dataset provided by 2015 MSCOCO Image Captioning Challenge. More about the evaluation server can be found here.
Explanation	While the model architecture is well documented, the model is still a deep neural network, which largely remains a black box when it comes to explainability of results and predictions.

Example: Algorithmic Impact Assessment Questionnaire

Accuracy	
Under what conditions/circumstances has the system been tested?	The model has been tested on the testing data set, which includes professional stock photos of humans, animals, buildings, and nature. It has not been tested on images that have been taken by laypeople using their phone cameras.
Have the vendors or an independent party conducted and published a validation report (including the methodology and results) that audits for accuracy and discriminatory/disparate impact? If yes, can the City review the study?	Yes, you can find the validation report on our company website. Link here: https://....com

Will the model be learning from the information it gets in the field during deployment?	No, the model will not be re-calibrating in the field. This would require manual modification of the algorithm or re-training of the model with new data by our engineers.
Equity	
What quality control is in place to test and monitor for potential biases in the AI system (e.g., non-representative training data, overfitting, hard-coded rules)?	The training data set was created in consultation with a representative sample of the US population by race, gender, and age to mitigate any biases in the text generated. We understand that people of different race, gender, and age may describe an image differently than one another, and continue to modify our training data to feature captions representative of the US population.
How can the City and its partners flag issues related to bias, discrimination or poor performance of the AI system?	There is built-in functionality in our program for the user to report one-off incidents of an inaccurate/biased output. This feedback informs the updates our engineers make to the training data and algorithm design, which would be reflected in later versions of the software. To report concern of a more comprehensive, systematic bias of the model, please contact abcdef@gmail.com.
Explainability	
What performance metrics were selected to judge the model's effectiveness? What is it optimizing for, and under what constraints?	Match quality of caption to image (reported by human reviewer) on a scale from 0-5. The model is optimizing for accurate descriptions of the image, and is penalized for lengthy caption text.
Are the outcomes of the AI system understandable by subject matter experts, users, impacted individuals, and others?	While the model architecture is well documented, the model is still a deep neural network, which largely remains a black box when it comes to explainability of results and predictions.