MACHINE LEARNING FRAMEWORK FOR SURFACE MATERIAL RECOGNITIO

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PROPRIETARY & CONFIDENTIAL

NaviFloor Robotics, Inc.

Document Version: 2.3

Last Updated: January 11, 2024

1. OVERVIEW AND SCOPE

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1. This document describes the proprietary machine learning framework (the

2. The Framework encompasses the complete technical architecture, training

2. DEFINITIONS

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1. "Training Dataset" means the proprietary collection of surface material sa

(a) High-resolution depth maps

(b) LiDAR point clouds

(c) Multi-spectral imagery

(d) Surface texture classifications

(e) Material property metadata

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2. "Core Algorithm" means the ensemble neural network architecture combi

(a) Convolutional neural networks for texture analysis

(b) Point cloud processing networks

(c) Multi-modal fusion layers

(d) Real-time inference optimization modules

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3. "Production Implementation" means the deployment-ready version of the

3. TECHNICAL SPECIFICATIONS

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1. Neural Network Architecture

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Primary backbone: Modified ResNet-152 with custom attention layers

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Point cloud processor: PointNet++ with terrain-specific augmentations

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Fusion network: Cross-modal transformer with 8 attention heads

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Inference optimization: TensorRT acceleration with INT8 quantization

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2. Training Infrastructure

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Framework: PyTorch 1.12

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Hardware: NVIDIA A100 GPU cluster

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Distribution: Horovod-based distributed training

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Containerization: Docker with CUDA 11.4 support

4. PROPRIETARY COMPONENTS

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1. Protected Algorithms

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Surface material classification pipeline

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Real-time depth map processing

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Multi-surface transition detection

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Dynamic friction coefficient estimation

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Terrain complexity scoring system

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2. Custom Dataset Elements

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Annotated industrial surface library

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Synthetic data generation pipeline

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Multi-sensor calibration matrices

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Environmental condition variations

5. PERFORMANCE METRICS

1. Classification Accuracy

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Overall accuracy: 98.7% on validation set

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Real-time inference speed: <15ms per frame

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False positive rate: <0.1%

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Surface transition detection latency: <50ms

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2. Resource Utilization

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GPU memory: 2.1GB (deployment)

CPU usage: <15% on Intel Xeon E5-2680

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Power consumption: 12W average

6. INTELLECTUAL PROPERTY PROTECTION

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1. The Framework and all its components are protected under:

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U.S. Patent No. 11,234,567 (Filed: 2019-05-20)

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U.S. Patent No. 11,345,678 (Filed: 2020-03-15)

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PCT Application PCT/US2021/123456

2. Trade Secret Protection

All implementation details, training methodologies, and optimization techniq
described herein are maintained as trade secrets under applicable state and
federal law.

7. ACCESS AND USAGE RESTRICTIONS

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1. Access to the Framework documentation and source code is strictly limite

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Authorized Company engineering personnel

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Licensed implementation partners

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Approved research collaborators

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2. Usage Limitations

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No reverse engineering permitted

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No unauthorized modifications

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No transfer or sublicensing without written consent

8. CERTIFICATION AND COMPLIANCE

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1. The Framework has been certified for:

ISO/IEC 27001:2013 compliance

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UL 3100 for Automated Mobile Platforms

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CE marking requirements for robotics systems

9. VERSION CONTROL

This document supersedes all previous versions of the Framework document

Version history:

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v2.3 (Current): January 11, 2024

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v2.2: October 15, 2023

v2.1: July 30, 2023

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v2.0: March 12, 2023

10. AUTHORIZATION

APPROVED AND ADOPTED by NaviFloor Robotics, Inc.

By:

Dr. Elena Kovacs

Chief Research Officer

Date: January 11, 2024