Center for Visual & Decision Informatics

A National Science Foundation Industry/University Cooperative Research Center

YEAR 8 – PROJECT PROPOSAL		
Title: Improved Decision Making for Autonomous Systems		**Project ID: 8a.005.UVA**
Today's Date:	**Estimated Start Date:**	**Type:** [ ] New [x] Continuing
Principal Investigator: Cody Fleming	**University: UVA**	**Email: cf5eg@virginia.edu**
Other Project Participants:		

Project Description: This project aims to improve data-driven decision-making models for an autonomous system, particularly with the goal of making explainable predictions for intent of other surrounding systems without any direct communication. The goal of this project is to improve the usability of and trust in such data-driven decision-making models by integrating human experts' decisions and feedback into the model's knowledge pool. The project will create a model that jointly reasons about and predicts a distribution over plausible decisions and uses human expert knowledge to generate an optimized decision. The application will focus on autonomous vessels at sea, with the goal of broad applicability to other domains.

Experimental Plan:

- Preliminary model design
- Literature Review
- Data Collection
- Prototype model

Related Work:

An explainable deep learning based model for predicting intent of maritime entities was developed as a part of CVDI Year 7 Project 'Improved Decision Making for Autonomous Systems' which models intent based on past observations, while also incorporating spatial interactions and temporal dependencies. The PI has experience with safety assurance for autonomous systems in air and land based domains.

How this project is different: The usability of data-driven decision-making solutions in safety-critical applications is limited by the absence of human-like inference and reasoning about decisions. Moreover, most models overlook the possibility of more than one feasible decision and end up optimizing on average behavior. This project is expected to improve decision-making models by incorporating human expert knowledge and interpretability in the model. The project will focus on maritime domain that has different conditions from land or air based research projects focusing on autonomous agents.

Milestones for Year 1:

6 months:

- *Preliminary design of total solution*
- *Literature Review*

9 months:

- *Prototype Model*

12 months:

- *Identify new research directions/final report*

Deliverables for Year 1:	**Proposed Budget for Year 1:**	
• Briefing of model design • Literature review document • Software and associated artifacts • Final report	Personnel	$ 0
	Students	$ 40,000
	Overhead	$ 5,000
	Other – Travel to Conference	$ 5,000
	Other *(describe)*	$ 0
	Total	**$ 50,000**

How this Project may be transformative?
This project will lead to explainable decision-making, inclusive of human expert feedback, for autonomous navigation in complex environments.

Potential IAB member benefits:
This project will directly inform technology development for autonomous systems. It will benefit any IAB member that is developing autonomous agents.

Year 8 – IAB Research Focus Areas *<Select the primary research area(s) the project addresses>*		**Project Collaboration** *<Select all academic sites collaborating with on project>*	
	Visualization & Data Analytics		Drexel University
x	Artificial Intelligence		Stony Brook University
	Ethics		Tampere University
	Cybersecurity		University of North Carolina at Charlotte
	Human Centric, Social Computing		University of Louisiana at Lafayette
	Other	x	University of Virginia

Proposed IAB Project Sponsors
<Insert bullet list>

(For Site Director Use Only)

Evaluation Score	Criteria Description	Maximum Score
	Relevance to industrial needs & priorities	40%
	Clear workable methodology & plan	20%
	Potential deliverables & products	15%
	Opportunity for cross IAB & cross partner university collaboration	15%
	Research team qualifications	10%
		100%

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Name of CVDI Site Director | Name of CVDI Academic Site | Today's Date

Approved by:
Steve Adams, PhD
University of Virginia
CVDI Site Managing Director
(3/15/2019)