

# Nadejda V. Drenska

School of Mathematics, University of Minnesota  
Vincent Hall, 206 Church St. SE  
Minneapolis, MN 55455

[ndrenska@umn.edu](mailto:ndrenska@umn.edu)  
<http://ndrenska.wixsite.com/ver0>

## Research Interests

Viscosity solutions of PDEs and optimal control theory applied to online machine learning problems from the area of ‘prediction with expert advice;’ semi-supervised learning analysis through the game-theoretic  $p$ -Laplacian.  
Broader: nonlinear analysis, PDEs, semi-supervised learning, repeated two-person games, graph theory, and applications in computer science.

## Current Position

MCFAM Postdoc at University of Minnesota, Twin Cities	2018-present
---	--------------

## Education

New York University – Courant Institute of Mathematical Sciences	2017
Mathematics Ph.D., adviser Robert V. Kohn, A PDE Approach to a Prediction Problem Involving Randomized Strategies	
Brown University	2012
B. Sc. in Mathematics with Honors and B. Sc. in Applied Mathematics with Honors, <i>magna cum laude</i>	
Sofia High School of Mathematics (Sofia, Bulgaria)	2007

## Publications

J. Calder and N. Drenska. **Semi-Supervised Learning and the  $p$ -Laplacian.** (*in preparation*)  
D. Mosaphir, J. Calder, and N. Drenska. **Analysis and Numerical Methods for Prediction with Expert Advice.** (*in preparation*)  
J. Calder and N. Drenska. **Asymptotically Optimal Strategies for Online Prediction with History-Dependent Experts.** *accepted, Journal of Fourier Analysis and Applications*, 2020  
N. Drenska and J. Calder. **Online Prediction with History-Dependent Experts: The General Case.** *accepted, Communications on Pure and Applied Mathematics (CPAM)*, 2020  
N. Drenska and R. V. Kohn. **A PDE Approach to the Prediction of a Binary Sequence with Advice from Two History-Dependent Experts.** *arXiv:2007.12732*, 2020  
N Drenska and R.V. Kohn. **Prediction with Expert Advice: a PDE Perspective.** *Journal of Nonlinear Science*, 30(1): 137-173, 2020

## Selected Talks

A PDE Interpretation of Prediction with Expert Advice	
WPI Colloquium	2021
Joint Mathematics Meetings	2021
OneWorld Machine Learning	2020
Optimal Control, Optimal Transport, and Data Science workshop, IMA	2020
LMS-Bath Symposium	2020
Two PDE Approaches to A Problem from Prediction with Expert Advice	
IPAM, UCLA	2020
Analysis and Applied Mathematics Seminar, UIC	2020
PDE Approaches to Two Problems from Prediction with Expert Advice	
Applied Interdisciplinary Mathematics Seminar, UMichigan	2019
A PDE Approach to Some Randomised-Strategy Two-Player Games	
IMA Data Science Seminar, UMN	2018

Materials Working Groups, NYU	2016
<b>A PDE Approach to Prediction with Expert Advice</b>	
WPI STEM Faculty Launch, WPI	2016
RPI Applied Math Days, RPI	2016
SIAM Conference on Analysis of PDEs, Scottsdale AZ (awarded SIAM Student Travel Award)	2015
Materials Working Group, NYU	2015

## Teaching Experience

<b>University of Minnesota</b>	2018 - present
Instructor for Multivariable Calculus, PDEs I and II	
Instructor and course supervisor for 13 Multivariable Calculus sections	2018
<b>Courant Institute of Mathematical Sciences, NYU</b>	2014, 2015
Teaching Assistant for Calculus I, PDEs, and ODEs	
<b>Mathematics Department, Brown University</b>	2009, 2010, 2012
Teaching Assistant and/or grader for Analysis, ODEs, PDEs, Multivariable Calculus	
<b>Division of Applied Mathematics, Brown University</b>	2011
Teaching Assistant for Methods of Applied Mathematics I, Methods of Applied Mathematics II	
<b>Math Resource Center, Brown University</b>	2009
Tutor for calculus, linear algebra, and methods of applied math (differential equations)	

## Teaching High School Students

Instructor for Machine Learning Virtual Summer Camp for high school students	2020
--	------

## Undergraduate Research Projects

<b>“Snaking Under Radial Perturbations”</b>	Summer 2012
supervisor Professor Bjorn Sandstede, presented at Summer at ICERM	
<b>Applied Mathematics Thesis: “Numerical Approximation of Spectra for Localized Oscillatory Structures”</b>	2012
Thesis Adviser Professor Bjorn Sandstede, Division of Applied Mathematics, Brown University	
presented at Summer Research Symposium and Theories in Action, Brown U	
<b>Mathematics Thesis: “Representation of Periodic Data with Fourier Methods and Wavelets”</b>	2012
Thesis Adviser Professor Jill Pipher, Mathematics Department, Brown University	
- presented at Mathematics Undergraduate Group under “Wavelet Approximations of Curves in the Plane”	

## Awards and Recognition

<b>Moses A. Greenfield Research Award</b> for Outstanding Interdisciplinary studies, Courant Institute, NYU	2016
<b>Rohn Truell Prize</b> to an outstanding undergraduate student in the Division of Applied Mathematics, Brown U	2012
<b>Sarah Dyer Barnes Scholarship</b> – Brown University	2011 - 2012
<b>Henry Parker Manning Prize Examination</b> – 1 <sup>st</sup> prize (Brown University mathematics competition)	2011
- graduated with Recognition for Outstanding Achievements in the Areas of Mathematics and Physics	
- National Diploma for Outstanding Achievements from the Minister of Education of Bulgaria	
Member of the <b>Bulgarian Extended National Team</b> for the International Mathematics Olympiad	2007
Member of the <b>Bulgarian Extended National Team</b> for the Balkan Mathematics Olympiad	2005
1 <sup>st</sup> and 2 <sup>nd</sup> prizes at National Physics Competitions	2005 - 2006

## Service

<b>Co-organizing an IMA workshop ‘Optimal Control, Optimal Transport, and Data Science’</b>	2020
with Jeff Calder, Dejan Slepcev, and Chai Wu	
<b>Co-organized a minisymposium ‘Partial Differential Equations in Machine Learning and Data Science’</b> with Jeff Calder at the SIAM Conference on Analysis of PDEs	2017
<b>President of The Courant Student Organization</b>	2014 - 2015
<b>President of The Department Undergraduate Group of Applied Mathematics</b>	2011 - 2012