JEREMY CLEEMAN

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EDUCATION

Rutgers University Graduate School of Engineering — **New Brunswick, NJ**

PhD in Mechanical Engineering/Machine Learning (GPA 3.9/4.0) — *May 2020 - Expected Dec 2025*

- **Fellowships**: National Science Foundation Graduate Research Fellowship, Rutgers Engineering Fellowship
- **Grants**: Rutgers Technology Advance ($75,000 for development of multiplexed thermoplastic 3D printer)

Rutgers University Undergraduate School of Engineering — **New Brunswick, NJ**

Bachelors of Science in Mechanical Engineering (GPA 3.8/4.0) — *Sept 2015 - May 2020*

- **Fellowships**: NASA Fellowship, Rutgers Aresty Fellowship, Rutgers JJ Slade Scholar, Rutgers Excellence Award
- **Clubs**: Rutgers Formula Racing (FSAE) Project Manager and Chassis Lead

RESEARCH/ EXPERIENCE

ADVANCED MANUFACTURING SCIENCES LABORATORY at RUTGERS — **New Brunswick, NJ**

Graduate Researcher — May 2020 - Present

Reinforcement Learning (RL) for Defense Against Cyber-Physical Attacks

- Developed a RL controller for live correction of product defects caused by cyber-attacks, maintaining product functionality, and preventing manufacturing shutdown, addressing a $1B annual economic burden
- Created a Computer Vision system capable of detecting and measuring defects in thermoplastic 3D printing, at the sub one millimeter scale, feeding data to the RL controller for calculation to drive parameter correction
- Built a Neural Network model to predict impact on product defect based on changes to process parameters, trained on experimental data and a mock cyber-attack, used as a cost-effective tool to train the RL controller
- Designed and implemented a reward function in an actor critic framework to train the RL controller to rapidly eliminate defects while avoiding machine hardware limits, to ensure future defects can be resolved
- Demonstrated RL controller capability to recuperate from unseen cyber-attack manipulations of uncontrollable manufacturing parameters, preserving part functionality and preventing systems shutdown

Smart-ML: Multi-Fidelity Transfer Learning (MFTL) Methodology Reducing Model Development Costs

- Created a new MFTL methodology to cost effectively and efficiently create parametric effect models for novel manufacturing processes, using large amounts of unvalidated, low-fidelity, simulation data and fine-tuning with minimal high-fidelity experiments, reducing development timeline by several years and costs by up to 70%
- Refined parametric effect models' large unvalidated datasets by using instance-based transfer learning, shifting importance weighting of low fidelity data points based on agreement with high fidelity experimental data
- Demonstrated SMART ML's ability to produce parametric effect models, for pulsed laser machining and thermoplastic 3D printing, with on par prediction capabilities and significant cost and time savings

Invention of Multiplexed Thermoplastic 3D Printer "MF3"

- Invented and fabricated a scalable thermoplastic 3D printer, termed "MF3," which uses multiple extruders to simultaneously print distinct part sections, for either singular large parts or multiple smaller parts, increasing printing speeds by up to 80% without compromising resolution or geometric complexity
- Wrote a tool path generation program for MF3 that creates a machine instruction file for a desired 3D object capable of leveraging the array of extruders to print distinct part sections simultaneously
- Created a LabVIEW program to translate machine instruction files into stage and extruder motor movements

Undergraduate Researcher — May 2018 – May 2020

- Created 3D circuits on thermally sensitive polymers using conductive nanoparticles and flashlight sintering, to enable embedding of functional electronics within 3D printed parts without compromising structural integrity

LOCKHEED MARTIN / VERTICAL LAUNCH SYSTEMS (VLS) — **Middle River, MD**

Mechanical Engineering Intern — Summer 2019

- Prepared calculations, schematics, and process documents for customer installation of technical systems

SKILLS AND INTERESTS

- Python, C++, PyTorch, TensorFlow, Reinforcement Learning, Computer Vision, Statistics, Probability, LabVIEW

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PUBLICATIONS

- Mangrolia, B., **Cleeman, J.**, Patel, A., Wei, S., Shao, C., Xu, H., & Malhotra, R. (2024). Continuing minimal-defect production under material integrity cyberattacks. *Manufacturing Letters*.
- Malhotra, R., **Cleeman, J.**, Jackson, A., Patel, A., & Pelegri, A. A. (2024). Throughput scaling and thermomechanical behaviour in multiplexed fused filament fabrication. *CIRP Annals*.
- **Cleeman, J.**, Agrawala, K., & Malhotra, R. (2023). Accelerated and inexpensive Machine Learning for manufacturing processes with incomplete mechanistic knowledge. *Manufacturing Letters*, *37*, 53-56.
- **Cleeman, J.**, Agrawala, K., Nastarowicz, E., & Malhotra, R. (2023). Partial-physics-informed multi-fidelity modeling of manufacturing processes. *Journal of Materials Processing Technology*, *320*, 118125.
- **Cleeman, J.**, Bogut, A., Mangrolia, B., Ripberger, A., Kate, K., Zou, Q., & Malhotra, R. (2022). Scalable, flexible and resilient parallelization of fused filament fabrication: Breaking endemic tradeoffs in material extrusion additive manufacturing. *Additive Manufacturing*, *56*, 102926. (**Highlighted by news media**).
- Jahangir, M. N., **Cleeman, J.**, Hwang, H. J., & Malhotra, R. (2019). Towards out-of-chamber damage-free fabrication of highly conductive nanoparticle-based circuits inside 3D printed thermally sensitive polymers. *Additive Manufacturing*, *30*, 100886. (**Highlighted by news media**).
- Hwang, H.-J., **Cleeman. J.,** Malhotra, R., "Flash Light Sintering of Silver Nanowire Films on Polyester Fabric", 47th SME North American Manufacturing Research Conference, NAMRC 47.
- In Progress Publication: Reinforcement Learning for Recuperation from Cyber Physical Attacks in Wire Arc Additive Manufacturing