Hybrid simulation approaches modeling ice cream processing and formulation for optimized sensory perception

Background

Developing high-quality ice cream requires a delicate balance between processing parameters, ingredient formulation, and sensory experience. General Mills is looking to leverage AI and ML-driven modeling approaches to optimize ice cream processing and formulation while ensuring that the final product maintains its expected sensory properties. Achieving an optimal balance between texture, mouthfeel, and stability while maintaining production efficiency is challenging due to the inherent variability in ingredients and processing conditions. Current methods rely on time-intensive physical experimentation, making it difficult to predict how formulation and process adjustments will impact the final product. To address this challenge, we seek hybrid simulation models (combining multiphysics and ML-based predictions), AI-powered ingredient interaction modeling, and consumer sensory experience prediction to develop a digital framework that links process parameters, ingredient composition, and end-product perception. A robust AI-driven system will enable rapid scenario testing, significantly reducing the time and cost associated with traditional R&D. By predicting the effects of changes in freezing conditions, mixing speeds, stabilizer concentrations, or ingredient substitutions, this approach will enhance production agility, improve product quality, and accelerate innovation. Ultimately, this will ensure that any changes in formulation or processing result in a final product that meets both manufacturing efficiency goals and consumer expectations.

What we're looking for

We are looking for innovative AI- and ML-driven approaches to improve ice cream processing and formulation. We are open to solutions that incorporate hybrid simulation, ingredient interaction modeling, and sensory prediction. Ultimately, we seek to integrate these models into a cohesive framework that accelerates innovation while ensuring product quality, efficiency, and consistency.

Solutions of interest include:

- AI driven ingredient interaction modeling to predict texture and stability
- Hybrid simulation framework using multiphysics modeling and machine learning
- Consumer sensory prediction model trained on preference and sensory data
- Digital twin of the manufacturing process to simulate and test production scenarios

Our must-have requirements are:
- Leverages AI or machine learning to improve ice cream formulation or processing
- Adaptable to different manufacturing conditions and ingredient formulations
- Includes consumer sensory prediction to forecast taste and texture preferences

Our nice-to-have's are:
- Predicts ingredient interactions and product properties
- Proposals that outline data needs and/or propose methods for acquiring or supplementing data

Acceptable technology readiness levels (TRL): Levels 6-9
1. Basic principles observed
2. Concept development
3. Experimental proof of concept
4. Validated in lab conditions
5. Validated in relevant environment
6. Demonstrated in relevant environment
7. Regulatory approval
8. Product in production
9. Product in market

What we can offer you

Eligible partnership models:

- Sponsored research
- Co-development
- Supply/purchase
- Licensing
- Material transfer

Benefits:

Sponsored Research
Funding is proposal-dependent, typically to support proof-of-concept projects with potential for long-term partnership.

Data
Access to company data may be provided, subject to partnership model and scope of collaboration.

Facilities and Services
Opportunities to use our R&D and production facilities for model testing and validation.

Expertise
Collaborate directly with subject matter experts in ice cream formulation, ingredient systems, and processing optimization.

Who we are

General Mills is committed to making food with passion and putting people first by delivering the tastes they love while improving the nutrient density, affordability, and accessibility of our products. We collaborate with scientists, universities, companies, and organizations around the world to strengthen our impact and bring our purpose to life.

Reviewers

Christine Ng
Fellow Future Transformations

Cyril Chaudemanche
Technology Manager

Andreas Schopf
Principal scientist

Carina Cammarota
R&D Applications and Technology Expert

Please contact the University of South Florida Technology Transfer o8ice representative for submission – Karla Schramm at kschramm@usf.edu