Patrick Allmann

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My objectives are to build secure software, to solve interesting problems, and to get better at naming things.

Authorized to work in the US for any employer

Work Experience

Backend Developer
Usko Privacy
August 2022 to January 2023

- Design, build, test, and maintain APIs and scripts for the app
- Designed and implemented bookkeeping system for Usko credits
- Designed and implemented credit monitoring and alerting
- Built integration tests for bookkeeping and monitoring systems
- Set up infrastructure for RBAC access controls and pg_audit logs
- Investigated privacy-preserving ways to issue credits cryptographically

Education

Doctoral degree in Mathematics
University of California - Santa Cruz, CA
September 2014 to September 2020

Bachelor's degree in Mathematics
University of California - Los Angeles, CA
September 2012 to March 2014

Skills

- Differential equations
- Writing skills
- Calculus
- Math
- APIs
- JavaScript
- Git
- REST
- Node.js

- PostgreSQL
- Docker
- TypeScript
- Bash
- Machine learning
- Data science
- Back-end development
- Jupyter
- Python
- GitHub
- Linux

Links

https://github.com/ap-19927/breakersq/

https://github.com/ap-19927/lr/

https://github.com/ap-19927/post/

https://roadpeoples.org

Publications

Modified mean curvature flow of entire locally Lipschitz radial graphs in hyperbolic space
https://onlinelibrary.wiley.com/doi/10.1002/mana.201800432
July 2019

We investigated a modified mean curvature flow and proved longtime existence of a solution to an intial value problem with certain parametrized initial data.

More specifically, we start with an n-dimensional surface in (n+1)-hyperbolic space with the further restriction that the surface is a locally Lipschitz radial graph in the upper half-plane model of hyperbolic space. This implies the surface can be parametrized by the upper unit hemisphere and has an asymptotic boundary, Gamma, parametrized by the (n-1)-sphere. We ask how would such a surface evolve under a certain quasilinear parabolic equation called modified mean curvature flow with its boundary fixed.

Such a flow of surfaces asks the velocity of the surfaces at each point and time (p,t) be equal to

(H(p,t) - sigma) nu(p,t),

if p is a point on the upper-hemisphere, t is positive, H(p,t) is the scalar mean curvature and nu(p,t) is the unit normal at point p and time t, and finally sigma is a constant.

Using derived gradient estimates and the maximum principle, we were able to prove that a solution to such an initial-boundary value problem exists, which can be represented by a family of n-dimensional locally Lipschitz radial graphs parametrized by the nonnegative reals and the upper unit hemisphere.

The so-called Asymptotic Plateau Problem (APP) is the elliptic version of the parabolic problem above. The APP asks if, given a scalar value, sigma, and an asymptotic boundary, Gamma, does there exist a n-surface in (n+1)-dimensional hyperbolic space with constant scalar mean curvature sigma and asymptotic boundary Gamma?

This flow is related to the APP because if a solution to such a flow exists and converges, then it must converge to a surface of constant mean curvature.

Additional Information

Some recent projects:

https://github.com/ap-19927/model
• A full-stack project based around an image classifier for a cat who we call Katja.
• Trained with a FastAI deep learning model based on photos of Katja I have taken throughout the years, and photos scraped from google images. This leads to an unintended consequence - the model may have learned to distinguish photos I have taken of cats and professionally taken photos of different cats, rather than distinguish Katja from other cats.
• Front end developed using Nuxt.js, which defaults to server-side rendering. This allows us to spawn a child process to run the inference (prediction) step using Python.
• Scripts to set up nginx reverse proxy and letsencrypt certificates through docker.

https://github.com/ap-19927/post
• Read, create and delete posts from a single thread of images and texts.
• Create and delete endpoints require authentication using passport.js.
• access to create and delete endpoints are only allowed from a given IP address. currently doesn't work with IPv6
• Scripts to set up nginx reverse proxy and letsencrypt certificates through docker.

https://github.com/ap-19927/lr
• Peer-to-peer messaging system.
• Self-hosted STUN/TURN server set up, which we had trouble dockerizing. I'd like to revisit this in the future for easy spin up and down of such services.
• User can use same ID across multiple devices
• Threads from each connected pair of clients are saved on the clients' local storage.

https://github.com/ap-19927/breakersq
• Zero knowledge authentication.
• Using SNARKS and circom circuit.
• Authenticates user using an EC key pair on the client side.
• server has to send a list of public keys to the client for client to check their private key against.
• if there's a match, a proof that there's a match is sent to the server.

• the server then authorizes the client to visit and redirects them to the index page which prints the proof received by the client
• the goal is to provide authorization to the client without requiring authentication.