

Epidemic Observation Network (EON): A Shared, Interactive Portal for Exploring Epidemiological Model Predictions

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Motivation

History of Infectious Disease:

Infectious disease has been a problem throughout all human history. For instance:

- The Black Death during 1347-1350 which killed ~60% of the European population.
- The West African Ebola Outbreak which resulted in the deaths of 11,310 individuals.

When comparing a plague of the past to something more modern, it is clear that there has been a dramatic change in the number of casualties due to infectious disease. One major reason for this is the development of the science of epidemiology.

Epidemiology and Modeling:

Epidemiology is the study of infectious disease and how it spreads within a defined population. An important tool used by epidemiologists to manage infectious disease outbreaks is modeling.

Models are essentially predictive networks of mathematical formulas developed by epidemiologists that show how disease can spread through a community. Given a set of initial conditions, a model can generate predictions of key outcome variables, such as how the fraction of the population that is infected changes overtime, speed of disease spread, and mortality rate. These models ultimately are an attempt at predicting how a disease will affect a population given what epidemiologists know about it. When a model closely represents the real world public health officials can plan properly and respond accordingly.

Issues with the Current Workflow:

It is not that this current workflow is at its core broken; it is simply that it could be further optimized. In the world of epidemiology there is a lack of an efficient system where epidemiologists from all around the world can critique and discuss one another's models to arrive at an optimized model that generates the best predictive measures.

Some specific problems with this workflow include:

- Epidemiologists lack an efficient way to share their models.
- These models can only appear in static form.
- Discussion with the entire community only begins at publication.
- Allowing other epidemiologists to use their code is dangerous in research.

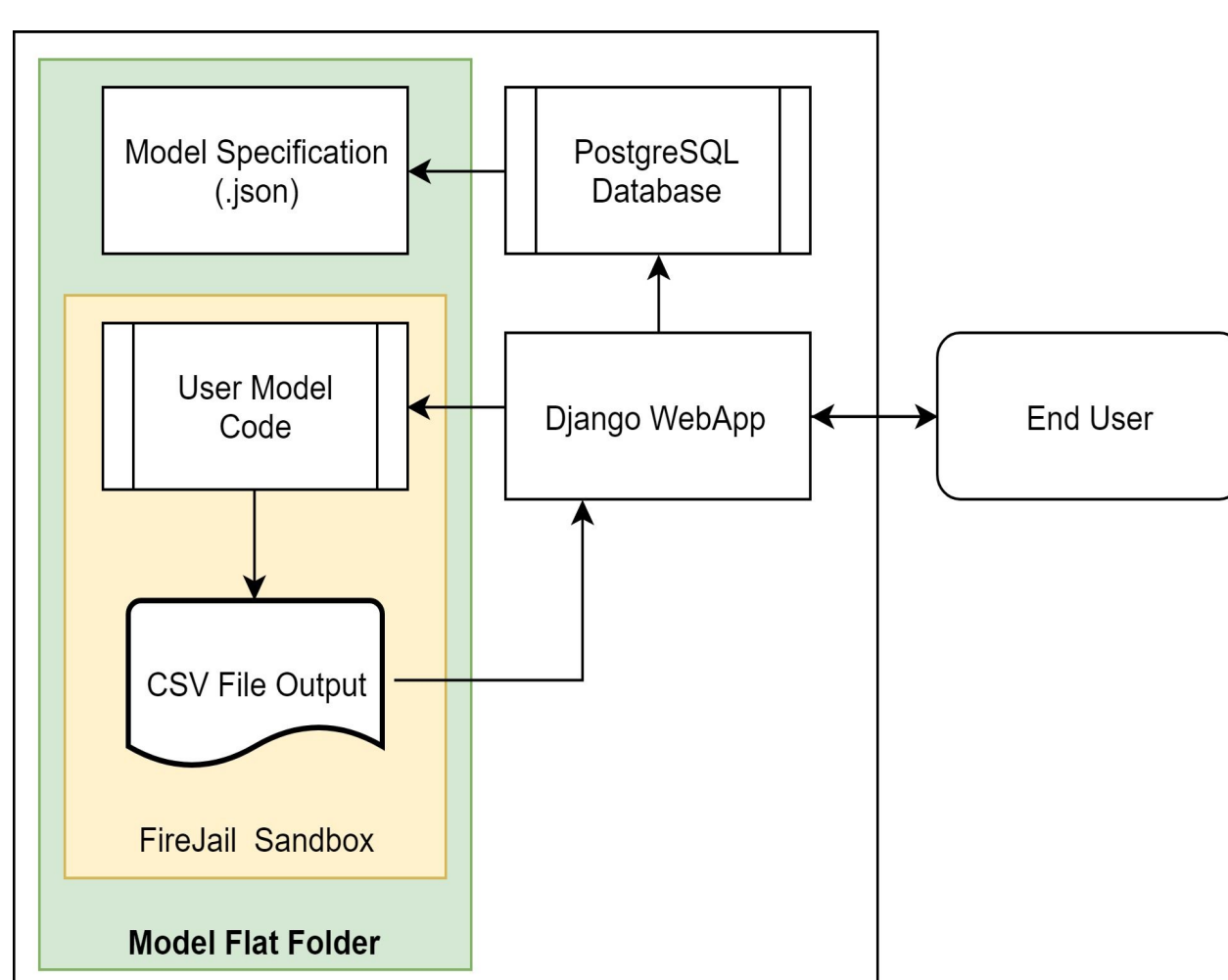
Solution Overview

Epidemic Observation Network (EON) which will be a secure, fast, and user friendly web application where epidemiologists from all around the globe can share and discuss their models.

EON will allow epidemiologists to:

- Create customizable user accounts.
- Upload and share custom models.
- Make these models public or private.
- Run and explore uploaded models.
- Discuss models and miscellaneous topics on forums.

Architecture



The user will send requests to the Django web application for all pages on the website. The PostgreSQL database will provide information to construct general user experience, and reference model specification (JSON) files. These JSON files will provide support for Django by holding relevant structure and descriptions of the graphs, and specifications about user code. When executing user simulation models, Django will run user code through the Firejail sandbox and process the produced CSV file into a graph.

Key Features

Features for EON were developed from numerous discussions with the client over the course of development. These features include:

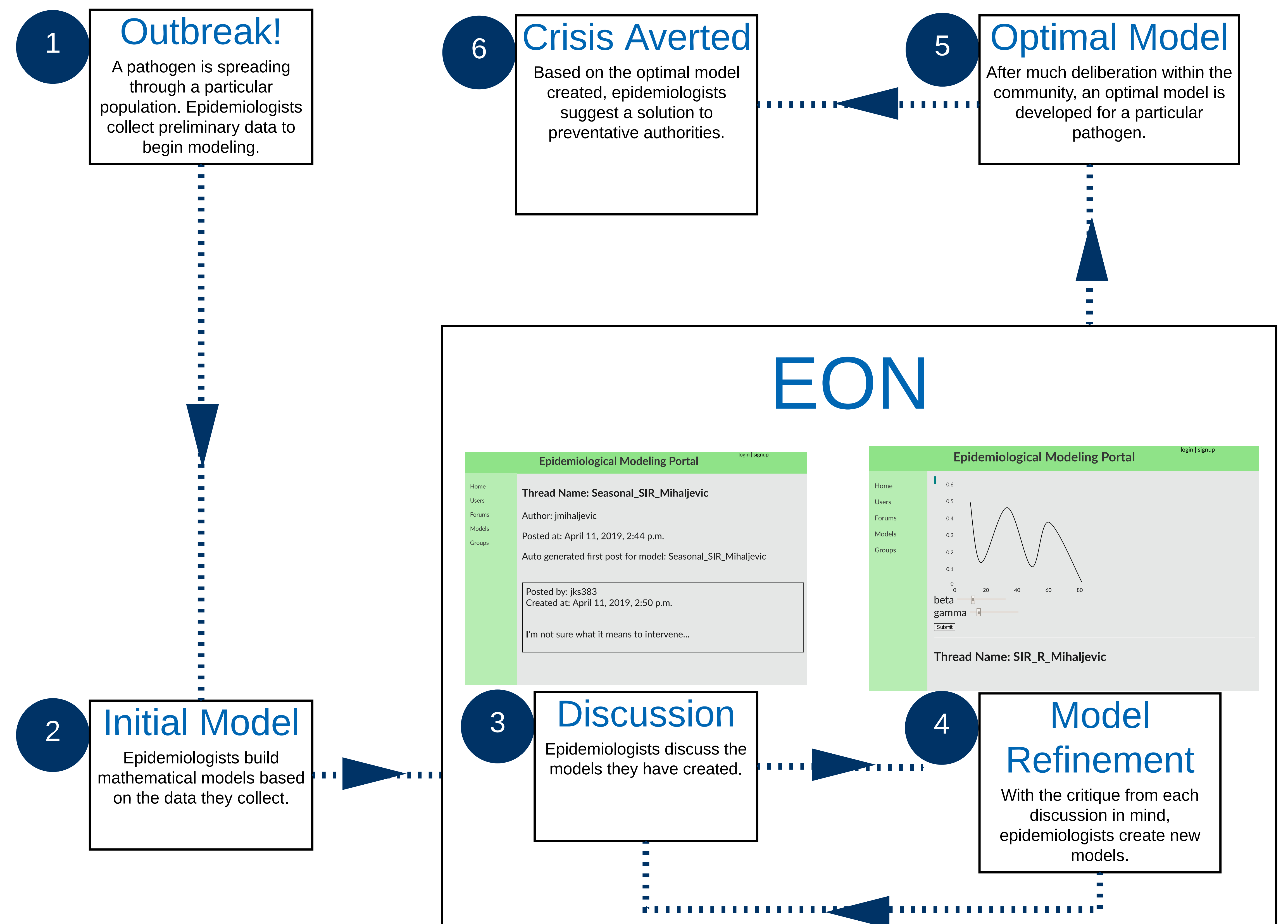
- Ability to model data on a two-dimensional graph.
- Ability to interact with models in real time to see how other parameters affect a model.
- Forums in which models can be discussed and critiqued.
- Groups for users to privately discuss and create models within.

Outcomes

EON ensures that the process of creating an optimal model is as smooth and quick as possible. By expediting the refinement process, EON will:

- Save more lives.
- Save more money.
- Ensure the best model is developed in time for proper preventative measures.

EON will be able to be used as a framework for future modelers who wish to share their models even outside the scope of epidemiology.



EON

Epidemiological Modeling Portal

Home
Users
Forums
Models
Groups

Thread Name: Seasonal_SIR_Mihaljevic

Author: jmihaljevic
Posted at: April 11, 2019, 2:44 p.m.
Auto generated first post for model: Seasonal_SIR_Mihaljevic

Posted by: jks383
Created at: April 11, 2019, 2:50 p.m.

I'm not sure what it means to intervene...

Epidemiological Modeling Portal

Home
Users
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Models
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beta
gamma

Thread Name: SIR_R_Mihaljevic