Forecasting changes in monthly fatalities in armed conflict. Proposal for a prediction competition and a journal special issue

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We invite you to participate in a joint effort to advance predictive modeling of changes in the severity of conflict. The core of your contribution will be to submit one or more models responding to the prediction problem we detail below in a friendly 'prediction competition'.

An external scoring team will evaluate the performance of the models according to a standardized toolkit, and award multiple prizes according to the set of criteria specified below. Based on an initial project description, a number of submitted proposal authors will be invited to a workshop and offered co-authorship of an article comparing the various contributions. Some of the authors will also be invited to contribute a description of their innovation in a form suitable for a special issue in an academic journal.

This document outlines the guidelines for submissions and describes the process. The project is organized by the ViEWS project (http://views.pcr.uu.se) and directed by a task group consisting of Håvard Hegre, Espen Geelmuyden Rød, and Michael Colaresi. More information on the ViEWS project is found at the end of this document.

Any questions regarding the project as well as submission of a project outline are to be sent to havard.hegre@pcr.uu.se with copy to liana.lopes@pcr.uu.se.

Process

The project will proceed in three stages. All prospective contributors are requested to submit a short proposal by 15 March 2020, up to 300 words in length. Shortly after, we will select an extensive subset of these proposals and invite their authors to develop a full model to be presented at a workshop in Uppsala 8–9 October 2020. ViEWS will be covering the costs of attending the workshop. We will distribute a package of data and code to everyone as a basis for building contributions. Contributions may be in the form of new models, new data, or a combination. In line with the rest of the ViEWS project, all input data must be publicly available and code completely shared.

For the workshop, contributors will be asked to submit a short text (about 5 pages) summarizing the model that will be presented. In addition, they will submit by 30 September 2020 two sets of forecasts based on the same model, as well as all the code and data required to replicate the results. The first set of forecasts will target January 2017–December 2019 and be based on data up to and including December 2016. The second set will be 'true forecasts' covering the following 6 months (October 2020–March 2021), based on data up to and including August 2020.[1] The project will store these forecasts in order to evaluate them against actual events in April 2021.

Just after the workshop, the task group will ask a selection of the contributors to extend the write-up to a full paper/research note (about 5000 words), and submit this selection as a special issue at a point in late 2020.

We will also accept contributions from people who are unable to attend the workshop, provided they deliver the same items as above, with a slightly longer text presenting the contribution.

An independent scoring committee will be assembled in February 2020. The committee will review and refine the scoring criteria and evaluate contributions when evaluation data are available.

Prediction problem

The challenge is to predict substantial change, upwards or downwards, in the count of the number of fatalities per month from state-based conflict – as defined by the Uppsala Conflict Data Program (UCDP) (`https://www.pcr.uu.se/research/ucdp/definitions/`) – and within the parameters set by the ViEWS project, over a subset of the forecasting horizon.

More precisely, the outcome to be predicted is

$$\Delta_s ln(Y_{i,t} + 1) = ln(Y_{i,t} + 1) - ln(Y_{i,t-s} + 1)$$

where Y is the number of fatalities recorded by the UCDP and aggregated to the ViEWS units of analysis.

By taking the natural logarithm of the fatality counts we seek to forecast multiplicative change – a change from 10 to 27 fatalities is seen as commensurate to one from 1,000 deaths to 2,700. Adding 1 to Y implies that a change from 0 to 1 fatalities is recorded as a change of $ln(1)$. $\Delta_s ln(Y_{i,t} + 1)$, then, is the change from log number of deaths in the month s months before t to the log number of deaths in the month of t.

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[1]The August 2020 data will be available to ViEWS and the contributors on 20 September 2020.

$s \in [1, 6]$ is the number of months forward to forecast. The current ViEWS system generates forecasts separately for each of 36 months into the future, but in this competition, the main scoring will be done for forecasts for each month up to 6 months into the future. Contributors may submit separate forecasts for each of the six $s \in [1, 6]$, or specify how to interpolate or extrapolate a lower number of forecasts.

Predictions can be made either at the PRIO-GRID month (*pgm*) or country-month (*cm*) level, as defined in Hegre et al. (2019).

The forecasts will be evaluated against the ViEWS' project's aggregation to the *cm* or *pgm* levels of the UCDP 'best' estimate for the number of battle-related deaths in state-based armed conflict in the UCDP-GED dataset (Sundberg and Melander, 2013). For details regarding the setup, aggregation rules, and the dependent variables in dichotomous form, see Hegre et al. (2019).

Scoring criteria

The competition will be friendly, with multiple 'prizes' according to several criteria. There will be no monetary rewards, but the best contributions will be described in the publication from the project, in the form of independent articles in a special issue or as part of the article that gives an overview of the entire project. Contributions will be scored according to the following criteria:

- Predictive performance of the model on its own – in the true forecasting window and the test window.[2]

- Predictive performance of model on top of the initial model ensemble provided by ViEWS, based on forecasts for the 2014–2016 window.[3]

- Design of features that contribute significantly to predictive performance

- Novelty/uniqueness: scores for predicting actual instances of change in conflict intensity that few other models pick up

- Interpretability/parsimoniousness

The exact scoring formula will be made more developed when we have established the scoring panel, but it will contain the following elements:

1. Scoring will be an aggregation of the following metrics:

    - Mean Square Error (MSE)
    - At the *pgm* level, to give credit to predictions that are close to an actual outcome in time or space even if slightly off, an adaptation of the pseudo-Earth Mover Divergence (pEMDiv) metric developed in Greene et al. (2019)

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[2]The true forecasting window is October 2020–March 2021. The test window is January 2017–December 2019. See (1) and (2) in the section 'What contributors will submit' below.

[3]See (3) in the section 'What contributors will submit' below.

2. If participants wish to cast the prediction problem as categorical, they are requested to use the categorization employed by ViEWS, with categories for 0, 1–5, 6–25, 26–100, 101–500, 501– fatalities. For such models, we will use a combination of average precision as well as recoding into median count within each category and evaluate using MSE.

3. Forecasts for the ViEWS calibration partition (from June onwards, the years 2014–2016) will be added as a separate model to an ensemble including the other contributions and the current ViEWS ensemble, and the extent to which the contribution improves on the ensemble will be evaluated using the same set of metrics.

4. About equal weight be given to the evaluation of three sets of forecasts submitted.

Data partitioning

We split the data into train/calibration/test as defined in ViEWS. Participants may train and tune models on all observations in the training and calibration partitions (1990–2012/2013–2015). All observations in the test partition (2016–2018)[4] are held out for true out-of-sample evaluation done by the scoring committee and the ViEWS core team.

What contributors will submit

Contributors will develop a forecasting model and make available the code needed to run it and any additional data not already in ViEWS, a 5-page summary of motivation, data and methods, and three batches of forecasts based on the model:

1. 'True' forecasts for **sb** conflict for each of the months October 2020 through March 2021, based on data up to and including August 2020.

2. Six sets of test forecasts for **sb** conflict for each of the months January 2017 through December 2019, for six different steps forward s, based on data up to one month before the step counter starts. The set of forecasts for $s = 1$, for instance, provides forecasts for January 2017 based on data up to November 2016; for February 2017 based on data up to Decemmber 2016, etc. up to December 2019. The set of forecasts for $s = 3$ provides forecasts for January 2017 based on data up to October 2016; for February 2017 based on data up to November 2017, etc.

3. A similar set of six sets of forecasts for **sb** conflict for each of the months January 2014 through December 2016, for six different steps forward s, based on data up to one month before the step counter starts.

What ViEWS can offer invited contributors

- Co-authorship on introductory article outlining the competition and the results

- Opportunity for inclusion in a special issue

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[4]In June 2020, the test partition will be extended to include all of 2019.

- By 20 March 2020: all the data currently in use by ViEWS, for the time frames given, and with code helping to set up the time shifting and other issues related to the multiple steps in the forecasting window.

- Plotting and mapping routines

- Evaluation routines

After the project is concluded

ViEWS will reserve the right to use the innovations in the ViEWS system (with due credit; also through co-authorship in the annual ViEWS article).

Overview of articles in special issue

We expect to invite 6–10 articles with substantive contributions from the workshop participants. In addition, the special issue will include (1) an introduction article presenting the project, the ViEWS setup, and the evaluation criteria for the project; (2) an article comparing the contributions, how they complement each other, and how they score on the evaluation criteria; and possibly (3) an article presenting a revised ViEWS ensemble and how the contributions jointly improve on the status quo.

We will approach journals in March 2020 when we have the list of invited contributions. In the event that we cannot find a journal that is interested in the project, we will seek to publish the collection as an edited book.

Each article in the issue will be subject to peer review. We will ask contributors to volunteer as reviewers for one or two other articles in the issue.

Article structure

Articles should be short and relatively uniform in structure. Maximum length should be about 5000 words. They should all include the following sections:

1. Short motivation, presentation of chosen forecasting problem

2. Data/feature engineering; brief substantive justification

3. Methods

4. Results: How predictions look; comparison with baseline model, intuitions regarding why the models predict what they predict

5. Evaluation: How they fare against other models in the ViEWS system

Since the contributions to a considerable extent use the joint ViEWS infrastructure, input data, and evaluation procedures described in the introduction, these elements can be very brief in each contributions.

The ViEWS project

ViEWS: A political Violence Early-Warning System (`http://views.pcr.uu.se`) is a research project financed by the ERC Advanced Grant scheme no. 694640, led by Dag Hammarskjöld Professor Håvard Hegre at the Department of Peace and Conflict Research, Uppsala University.

ViEWS signals risk of organized political violence up to 36 months into the future in the form of monthly probabilistic assessments of the risk and likely severity of state-based, non-state, and one-sided violence, as coded by the Uppsala Conflict Data Program (UCDP). Forecasts are generated for two levels of analysis: the country-month (*cm*) and PRIO-GRID-month (*pgm*) levels. The latter is defined by fine-grained geographical locations known as PRIO-GRID-cells, a quadratic grid structure that covers all areas of the world with cells measuring 0,5 x 0,5 degrees, spanning approximately 55 square kilometers along the equator. In the near future, also the actor level will be embedded into ViEWS' models.

ViEWS offers a novel integration of isolated causal factors that have been identified through decades of peace research into a theoretically and methodologically consistent forecasting system, further informed by conflict data spanning 30 years in time. The result is an early-warning system of unprecedented scope and performance that is publicly available, transparent, continuously developed, tested and iteratively improved.

Funding	Collaborations	Publications
ViEWS is funded by the European Research Council, grant number 694640 and Uppsala University.	ViEWS has an active interaction with other projects, including the CLIMSEC, CAVE and CROP projects at PRIO, the MISTRA-geopolitics project, and most importantly, the Uppsala Data Conflict Program (UCDP).	ViEWS' source code and full body of publications are accessible at: ✉ views@pcr.uu.se 🌐 `https://views.pcr.uu.se` ⭘ `https://github.com/UppsalaConflictData Program/OpenViEWS`

References

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