Forecasting the Israeli 2015 elections using a smartphone application

Yoav Ram, Ofer Moshaioff, Idan Cohen, Omri Dor

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Abstract

We developed a smartphone application, Ha’Midgam, to poll and forecast the results of the 2015 Israeli elections. The application was downloaded by over 7,500 people. We present the method used to control bias in our sample and our forecasts. We discuss limitations of our approach and suggest possible solutions to control bias in similar applications.

Introduction

The 19th Knesset, elected on January 22nd, 2013, was officially dispersed on December 8th, 2014. The elections for the 20th Knesset, which were supposed to be held on November 7th, 2017, are to be held on March 17th, 2015, more than two years before scheduled and just two years and two months after the previous elections.

During the weeks after the elections were declared, Ofer Moshaioff, Yoav Ram and Idan Cohen developed a smartphone application ('app') called Ha’Midgam (http://hamidgam.com). This app allowed users to anonymously vote for one of the major participating parties in the upcoming elections (2015), to disclose their vote in the previous elections (2013), and to view a forecast of the 2015 election results based on the aggregated data from all users.

The app was published for Android devices on the Android Play Store on December 29th, 2014 and for iOS devices (iPhone, iPad; developed by Elad Ben-Israel) on the Apple App Store on January 26th, 2015. It quickly gained media attention on local radio shows, digital media and newspapers. This media attention contributed to over 7,500 application downloads by March 16th, 2015.
Our app differs from traditional polls in several aspects. In traditional polls, media outlets publish forecasts based on a group of 500-1,000 individuals that were chosen by a polling company at a specific point in time to reflect an unbiased sample of the population.

In contrast, our app allows users to view a realtime, online forecast of the elections based on individuals that chose to disclose their vote. Therefore, the sample size in our app is roughly 10-fold. However, in contrast to traditional polls, our app doesn’t collect any demographic information, such as age, socio-economical status, religion or ethnicity. Therefore, our app’s sample may be biased and therefore requires statistical manipulation.

Our app does collect information that is unique: the app allows users to change their mind at any time; it keep a history of user choices; it logs the precise time and, if allowed by the device, location; and most importantly for the sake of this manuscript, the app asks users to disclose which party they voted for in the previous elections (2013). Our hypothesis was that this information could be enough to make a good forecast of the elections results - the distribution of seats between the participating parties.

In this manuscript we describe how the app works, the methods we used to manipulate the data, and the forecasts we got. We wanted to make this manuscript available before the elections day begins and therefore this manuscript in it’s current form includes only basic analysis.

**Methods**

**App technical description**

The mobile client was developed for the Android and iOS smartphone operating systems (the iOS version didn’t include the entire feature set). The app communicated with a RESTful API server, developed using Python 2.7 and the Flask web application framework and hosted on heroku, largely following a tutorial by Miguel Grinberg.

The app presents to the user a grid of the parties, including some basic information and a link to the party home or Facebook page. The user can vote to a specific party, at which point the results forecast screen appears. The user can view the number of seats per party. At any time the user can change his vote. In the Android version additional features were implemented; most importantly, users were asked to disclose their vote in the 2013 elections. In addition, users could see the geographical distribution of the votes by the country main administrative regions.

**Seats distribution forecasting**

We only describe our latest approach with some variations. The basic problem is how to control bias in our vote sample. Although our sample has over 7,500 votes, it could be biased due to several factors such as age, socio-economical status, and party activist propaganda.

**Bias control**

We started asking users for their 2013 elections choices on February 13th 2015. We used this information, together with the 2013 elections official results to attempt to control sample bias.
First, we take only the latest vote for each device id, both from the 2013 and the 2015 datasets. Next, we calculate a counts matrix $C$ with rows for 2015 parties, columns for 2013 parties: $C_{i,j}$ is the number of individuals who voted for party $j$ in 2013 and will vote for party $i$ in 2015. Next, we use the counts matrix $C$ to estimate the transition matrix $M$ in which $M_{i,j}$ is the probability that an individual who voted for party $j$ in 2013 will vote for party $i$ in 2015. This was done by normalizing the columns: $M_{i,j} = \frac{C_{i,j}}{\sum C_{i,j}}$.

We then generate the 2013 results vector $v$ from the official results data, removing counts of parties for which we have no information as well as illegal or discarded votes. We multiply the transition matrix by the results vector to get the forecast vector: $f = C \cdot v$. The forecast vector $f$ describes our prediction of the number of votes each party will get in the 2015 elections.

To get a forecast of the number of seats for each party we process the forecast vector $f$ using the Bader-Offer method, also known as the Hagenbach-Bischoff system. In our version of the Bader-Offer method we disregarded surplus vote agreements.

The multiplication of the transition matrix with the 2013 results vector can be viewed as giving different respondents different weights. If $c_i$ respondents replied that they voted for party $i$ in 2013, then in the normalized transition matrix, each such respondent has weight $1/c_i$. When we right-multiply the matrix with the actual 2013 results vector $v$, each respondent ends up with the weight $v_i/c_i$. With this weighting scheme, the total weight of respondents that claims to have voted for party $i$ in 2013 is the same as the actual number of voters for $i$ in 2013. Our sample now ‘agrees’ with the actual 2013 election results. To recap, we inserted a weighting scheme that controlled for the publicly known 2013 election results.

**Additional bias control**

As another layer of bias correction, we experimented with fixing the number of votes received by parties that represent four demographies to the number of votes in 2013. These demographies are:

1. The arab sector, represented by Hadash, Balad & Raam-Taal in 2013 and by the Arab Unified List in 2015.
2. The Ashkenazi-Orthodox sector, represented by Yahadut Ha’Tora both in 2013 and in 2015.
3. The Sfaradi-Orthodox sector, represented by Shas and Am Shalem in 2013 and by Shas and Yachad in 2015. Because Yachad merged with Ozma La’Am for the 2015 elections, we included Ozma La’Am in the respective 2013 votes.
4. The liberal, pro-cannabis legalisation party, Ale Yarok.

Fixing the number of voters of the first three demographies can be justified by the relatively constant number of seats their respective parties received in the previous three elections and by the sectoriality of these parties. As for fixing the number of votes of Ale Yarok, this was considered necessary because supporters of this party are known to be very active online, thus generating biases in online surveys and polls. For example, the number of “Likes” Ale Yarok has in Facebook is 85,709, compared with 27,205 Ha’Likud, the major right winged party, has.
Results

Using the procedure above and based on the votes as of 16th March 2015, the app has made these forecasts:

| Party                        | Raw | Stand. | Fixed: AY | AY, YH, AU | AY, YH, AU, S |
|------------------------------|-----|--------|-----------|------------|---------------|
| Ha’Mahane Ha’Zioni           | 32  | 25     | 26        | 25         | 26            |
| Ha’Likud                     | 17  | 21     | 22        | 21         | 22            |
| Yesh Atid                    | 16  | 15     | 16        | 15         | 16            |
| Ha’Bayit Ha’Yehudi           | 12  | 13     | 14        | 13         | 14            |
| Yachad                       | 10  | 9      | 10        | 9          | 9             |
| Merez                        | 13  | 9      | 9         | 9          | 9             |
| Arab Union                   | 0   | 7      | 8         | 11         | 12            |
| Kulanu                       | 6   | 6      | 6         | 6          | 6             |
| Ale’Yarok                    | 10  | 6      | 0         | 0          | 0             |
| Shas                         | 4   | 5      | 5         | 5          | 0             |
| Yahadut Ha’Tora              | 0   | 4      | 4         | 6          | 6             |
| Israel Beytenu               | 0   | 0      | 0         | 0          | 0             |

The numbers in the table represent a forecast of the number of seats for each party. Raw: based on raw data, 7,506 votes. Stand.: data standardized using a 2013 to 2015 transition matrix (see Methods), 2,447 votes. Fixed: data standardized using the transition matrix, and number of votes of specific parties were fixed at their 2013 values (AY: Ale’Yarok; YH: Yahadut Ha’Tora; AU: Arab Union; S: Shas). Note that the minimal number of seats in the 2015 elections is four. This is in contrast to previous elections in which the minimal number of seats was two.

The raw data, with obfuscated timestamps and locations, may be available upon request to the first author, depending on the purpose of use.

Discussion

Errors and Biases

When compared to major polling companies and their ongoing polls published in the media, it seems that several parties are under-represented while others are over-represented, even after introducing our statistical controls. Some notable examples are:

- The left-wing party Meretz gets 9 seats but only 4-5 seats in most polls.
- The right-wing party Yachad gets 9-10 seats but only 4-5 in most polls.
- The separatistic-orthodox party Shas gets only 4-5 seats but 8 in most polls.
- The right-wing party Israel Beytenu gets only 0 seats but 4-5 in most polls.

One possible source of bias is the influence of abstention (non-voting). Our approach doesn’t include a mechanism to assess changes in turn-out. While we did ask our respondents whether they abstained in 2013, it would be naïve to assume that they represent the non-voting population. A non-voter is presumably indifferent and would not participate in our poll. Those
who do participate, probably intend to vote in 2015. We could therefore easily reach the false conclusion that turn-out will increase to nearly 100% giving those users who reported abstention in 2013 unreasonably high weights. Eventually we chose to ignore possible changes in abstention, implicitly assuming that the voting population is constant and that we need only to infer if and how they will change their vote. In particular, there are media reports that turn-out will increase dramatically in the Arab population, which could increase the number of seats for the Arab Union.

Other possible sources of bias are several demographic variables that we did not control. Since we are already control for the 2013 election results (i.e. our weighted sample agrees with the official 2013 results), the following question is of relevance to the sources of bias: In what way are our respondents that voted for party \( i \) in 2013 different from the actual voting population that voted for party \( i \) in 2013? Some variables that may have played a role in biasing our sample could be:

- **Age.** It is reasonable to assume that young voters are more likely to vote for new, small, niche or extreme parties than are older voters. For example, older voters who voted for Ha’Likud in 2013 are more likely to vote again to Ha’Likud than are younger voters, who are in turn more likely to switch to Yachad or Kulanu. This same bias could explain the high number of seats projected for Merez and the low number of seats projected for Israel Beytenu.
- **Sex.** It is possible that men changed their minds (between 2013 and 2015) in a manner different from women. Ha’Mahane Ha’Zioni has a high level of female representation, including Livni who is set to become prime minister through rotation with Herzog. As an example, women who voted for Yesh Atid in 2013 might be more likely to switch to Ha’Mahane Ha’Zioni than men who voted for Yesh Atid in 2013.

Another source of error could be the sample size. 2013 votes were only collected from respondents after February 13th, and only in Android devices. Therefore, the 2013 dataset contains only \(~2,400\) votes, roughly a third of our entire sample. Due to our methodology, it is imperative to have a reasonable sample size for each voter ‘weight class’, which is decided in our case by the voter’s 2013 vote. For instance, we might have 400 respondents who voted Ha’Likud in 2013, but only 5 that voted Shas. Those few respondents in the 2013-Shas weight class will get high weights, likely leading to large errors. Due to time limitations, we did not have the time to estimate these errors, so it is likely that they explain at least some of the deviance in our forecast. In particular, this could explain the low number of seats projected for Shas, Yahadut Hatora or Israel Beytenu.

**Conclusion**

Ha’Midgam app offered Israelis a chance to express their voice in an online, realtime, open poll and to view a live forecast of the upcoming 2015 Israeli elections results. It is likely that our poll suffers from sample bias. However it serves as an important proof of concept. We believe that with better bias controls, additional demographic information and a marketing effort targeted at specific under-represented demographics a smartphone app can become a precise poll and make forecasts as good as the major national polls.