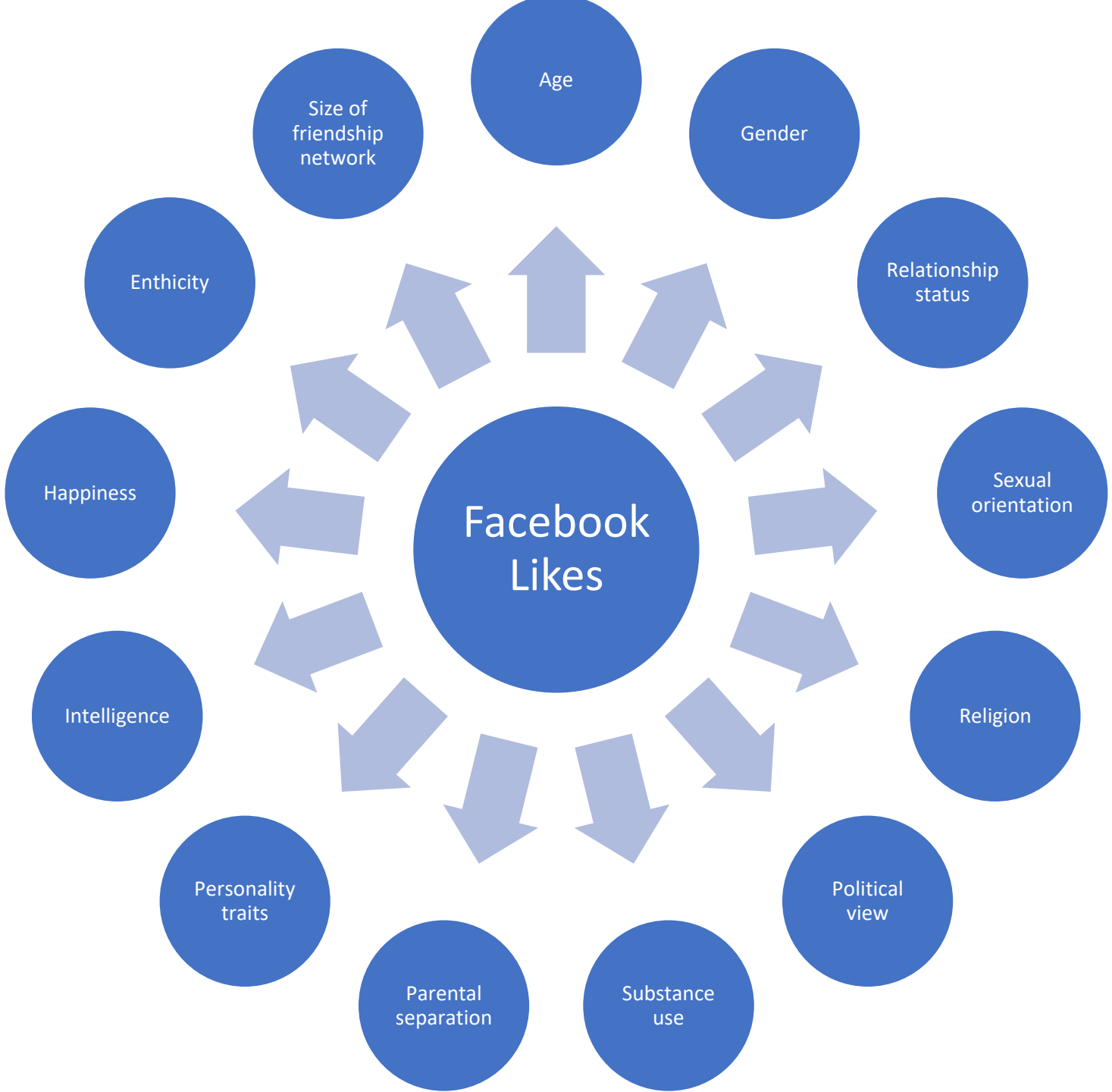
Paper Presentation

- M. Kosinski, D. Stillwell, T. Graepel. *Private traits and attributes are predictable from digital records of human behavior*. PNAS, 2013

Do you hide well on social media?


Facebook Likes
Age
Gender
Relationship status
Sexual orientation
Religion
Political view
Substance use
Parental separation
Personality traits
Intelligence
Happiness
Enthicity
Size of friendship network

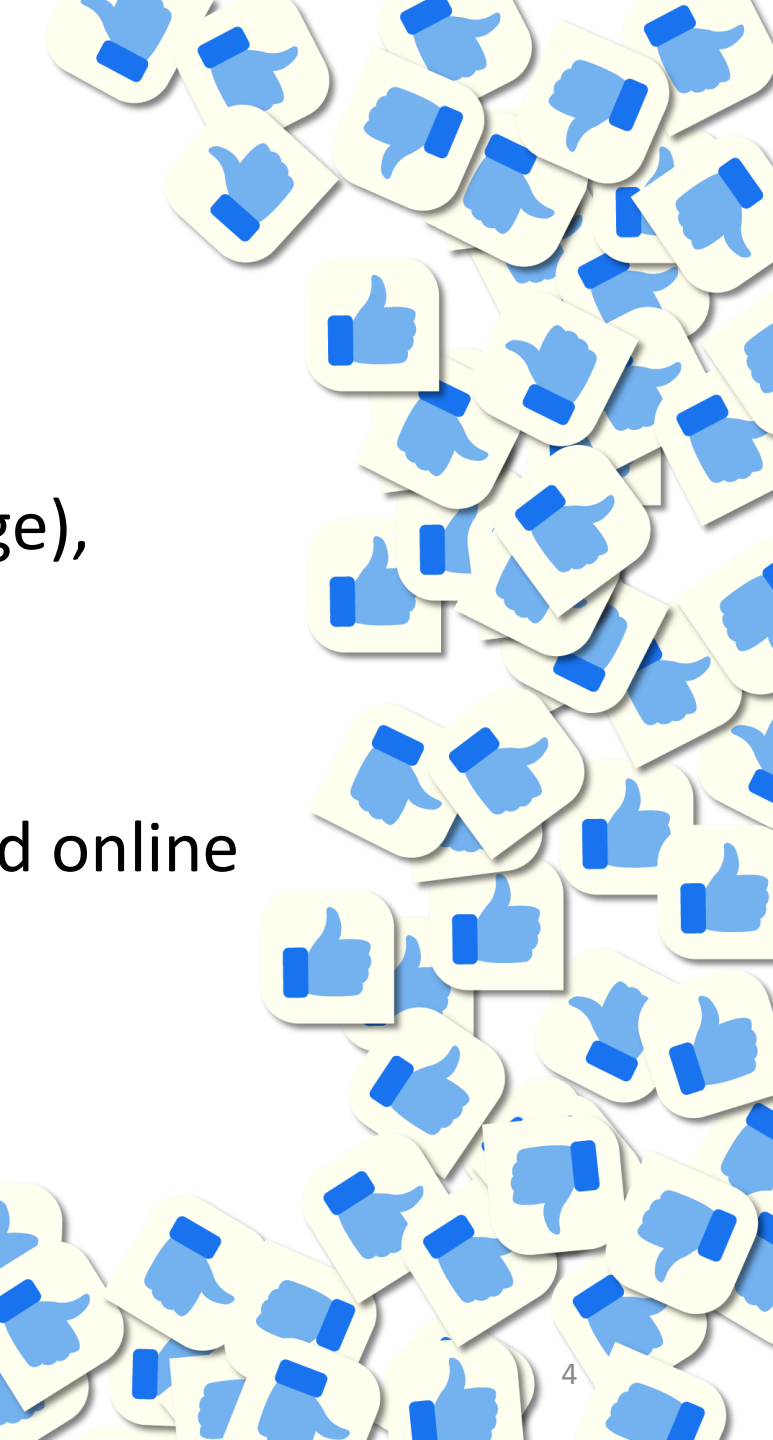
Dataset

- 58,466 volunteers from the United States
- A list of their

  Facebook Likes (170 likes per person on average),

  detailed demographic profiles,

  results of several psychometric tests.
- Demographic profiles: through Facebook profile and online survey



EPFL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Design of the study

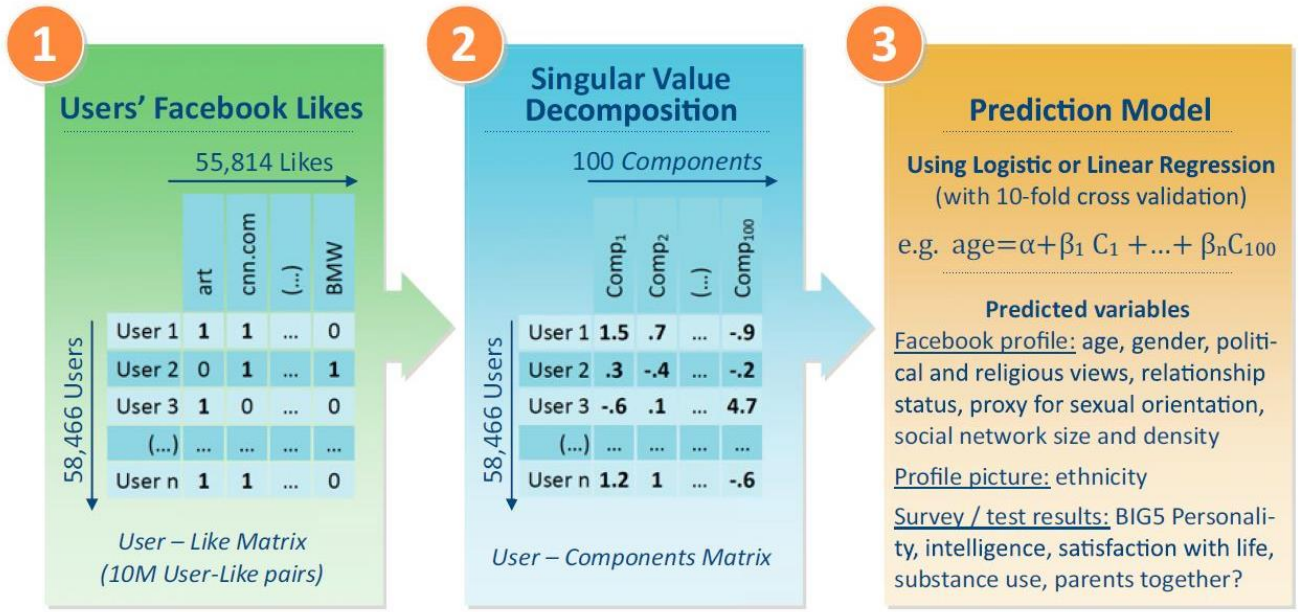

Fig. 1 Design of the study

- Users and their likes were presented as a sparse user-like matrix.
- The dimensionality of the user–Like matrix was reduced using singular-value decomposition (SVD).
- For numeric variables, linear regression model with 10-fold cross-validation and k =100 top SVD components was used.

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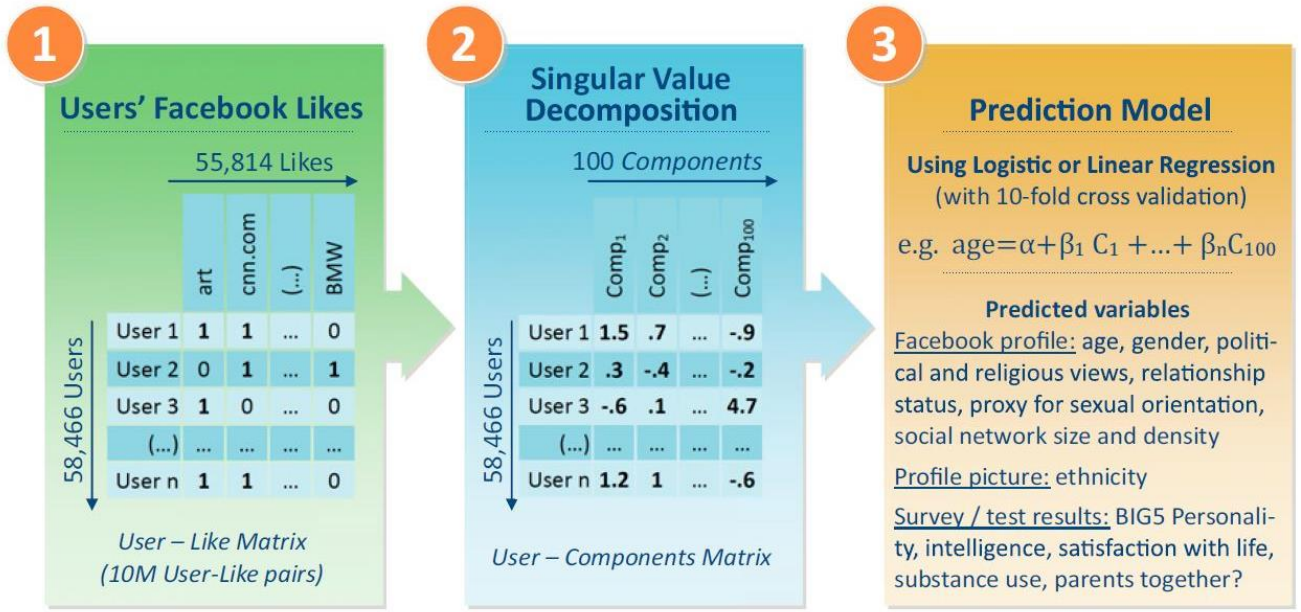

Fig. 1 Design of the study

- For dichotomous variables, logistic regression with 10-fold cross-validation and k =100 top SVD components was used.
- For sexual orientation, parental separation, and drug consumption only k = 30 top SVD components were used because of the smaller number of users for which this information was available.

Results – prediction of dichotomous variables

- The highest accuracy was achieved for **ethnic origin** (95%) and **gender** (93%).

suggesting that patterns of online behavior as expressed by Likes significantly differ between those groups.

- **Religions** were correctly classified in 82% of cases, and similar results were achieved for **political view** (85%).
- **Sexual orientation** was easier to distinguish among males (88%) than females (75%).

which may suggest a wider behavioral divide (as observed from online behavior) between hetero- and homosexual males.

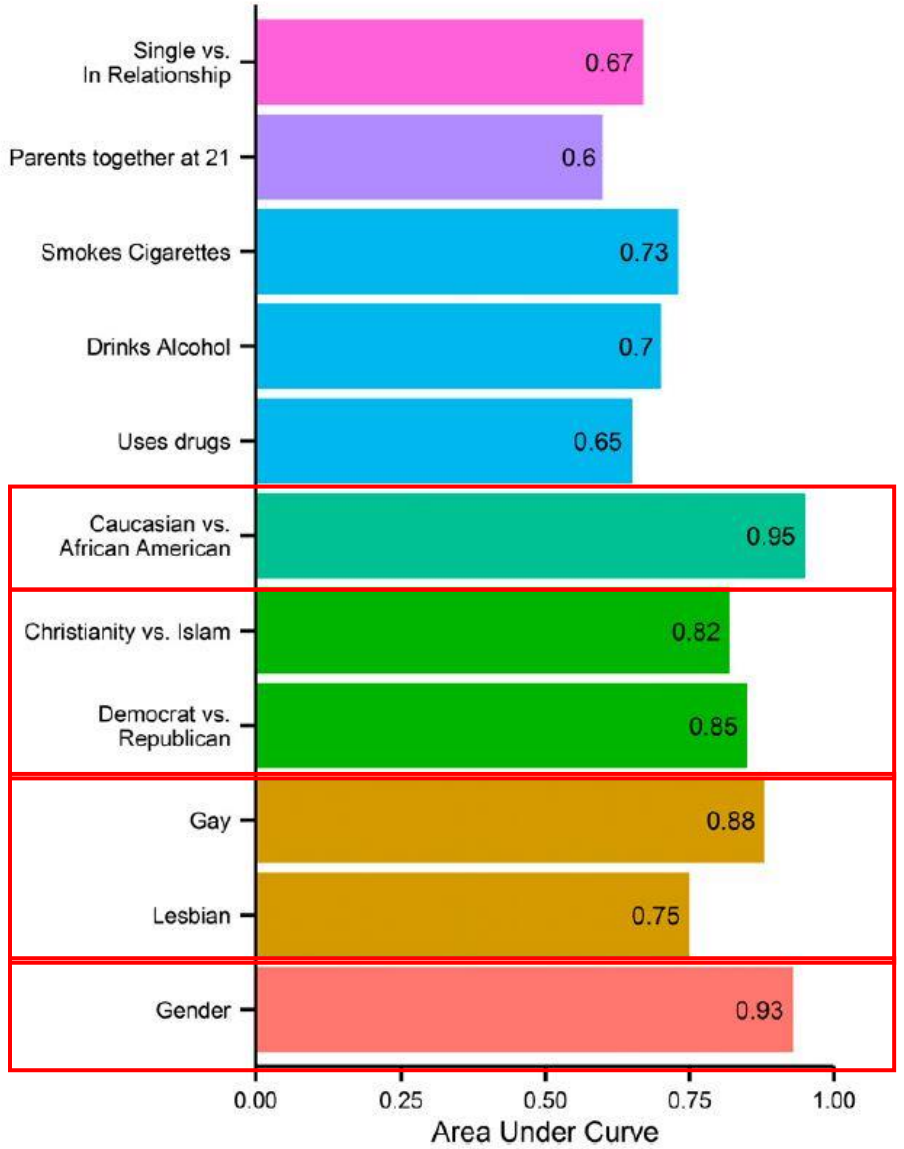

Fig. 2 Prediction accuracy expressed by the AUC

Results – prediction of dichotomous variables

- Good prediction accuracy was achieved for **relationship status** and **substance use** (between 65% and 73%).

The relatively lower accuracy for relationship status may be explained by its temporal variability.

- Accuracy was lowest (60%) when inferring **parental separation** before users were 21 years old.

It is remarkable that this is detectable through their Facebook Likes.

Individuals with parents who separated have a higher probability of liking statements preoccupied with relationships, such as “If I’m with you then I’m with you I don’t want anybody else”.

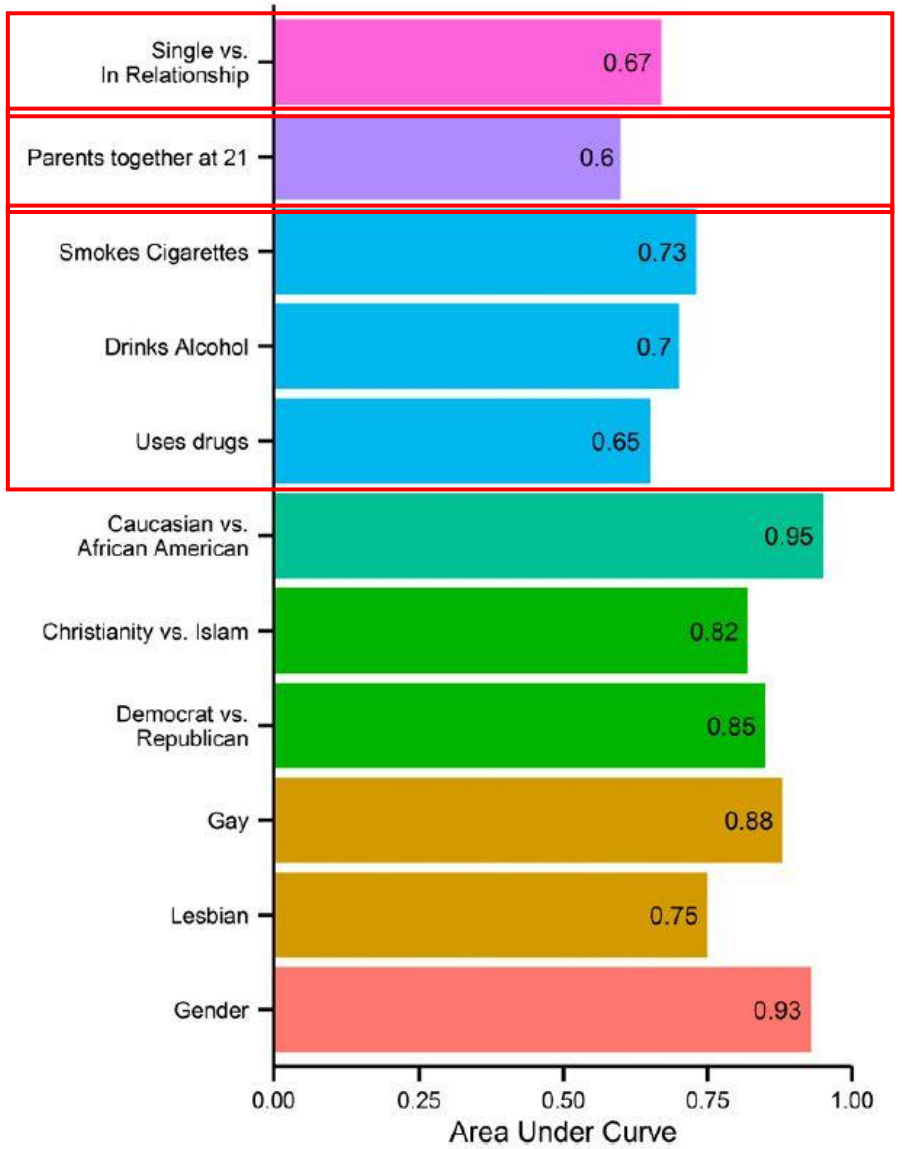

Fig. 2 Prediction accuracy expressed by the AUC

Results – prediction of numeric variables

- Accuracy expressed by the Pearson correlation coefficient.
- Significance level at $P < 0.001$.
- The transparent bars indicate the questionnaire's baseline accuracy.

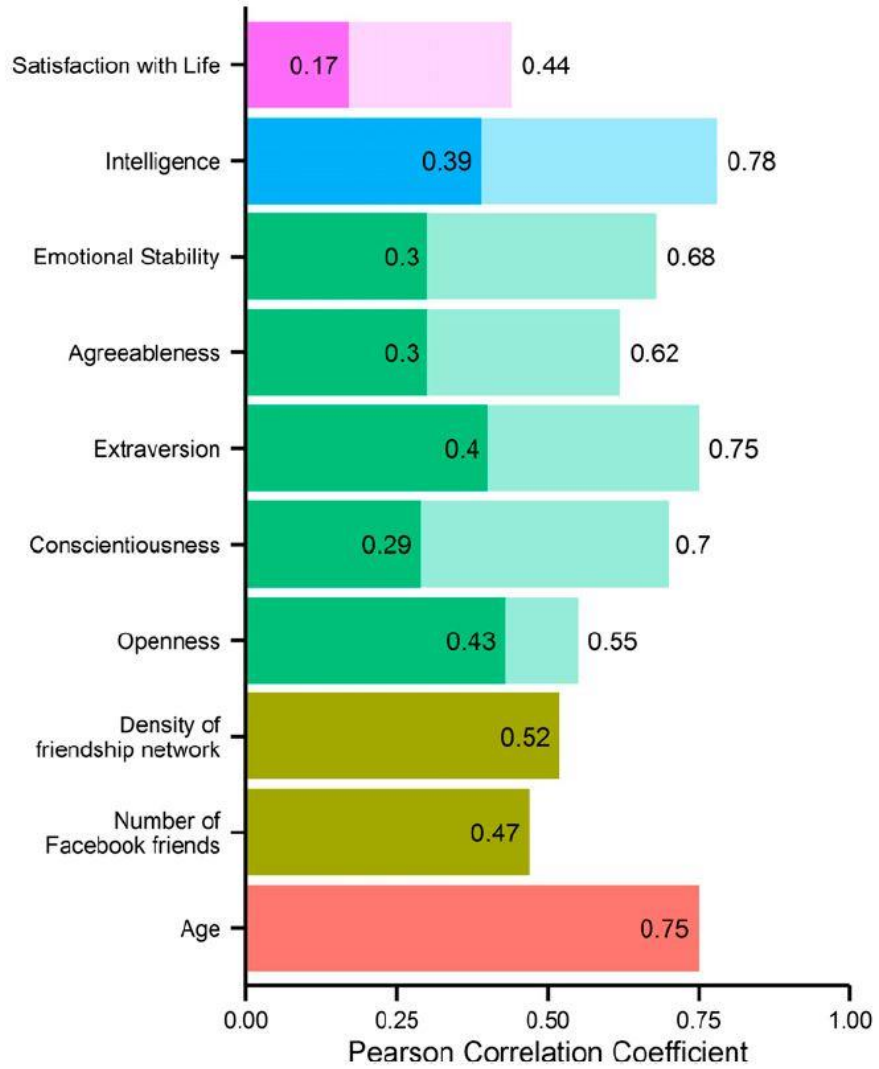

Fig. 3 Prediction accuracy for numeric variables

Results – prediction of numeric variables

- The highest correlation was obtained for **age,** followed by **density** and **size of the Facebook friendship network**.
- The correlation between the predicted and actual **Openness** score (r = 0.43) was very close to the test–retest reliability for Openness (r = 0.55).

For the Openness trait, observation of the user's Likes is roughly as informative as using their personality test score itself.

- For the remaining traits, prediction accuracies correspond to roughly half the questionnaire's test-retest reliabilities.
- The relatively lower prediction accuracy for **SWL** (r = 0.17) may be attributable to the difficulty of separating long-term happiness from mood swings.

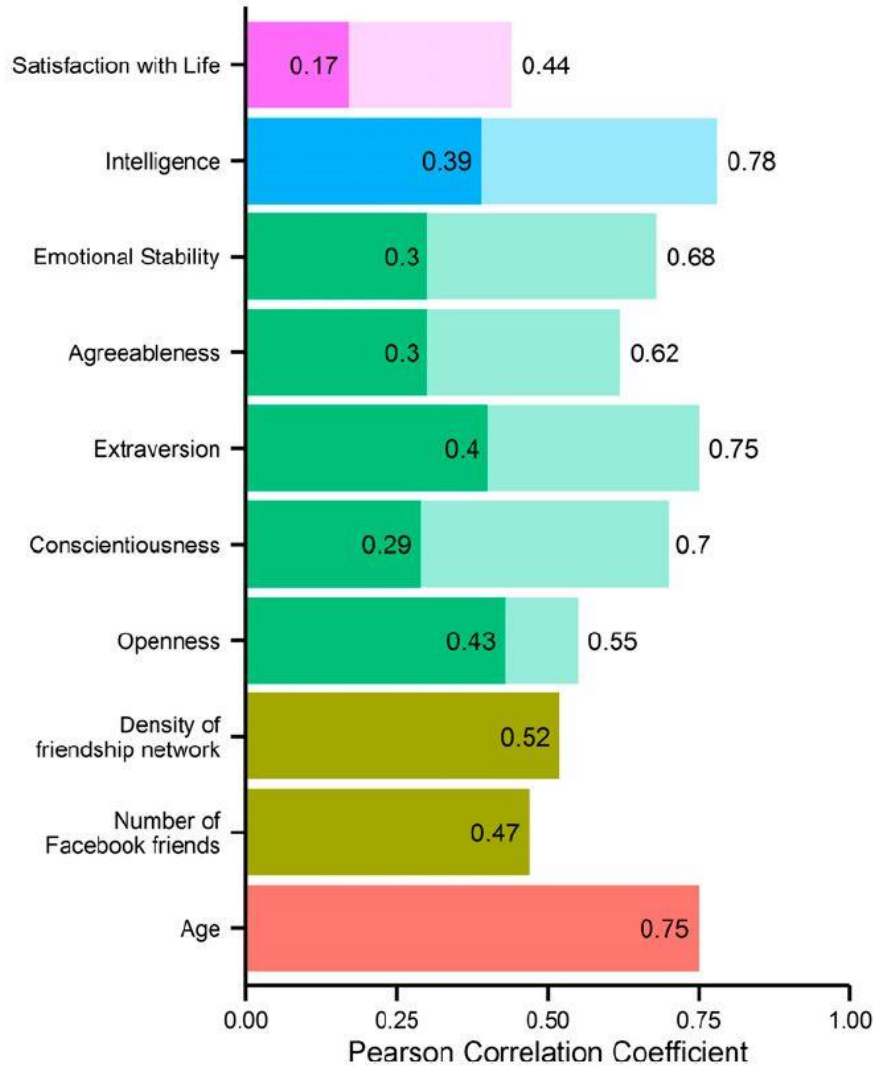

Fig. 3 Prediction accuracy for numeric variables

Amount of Data & Accuracy

- What is the expected accuracy given a random individual and how does prediction accuracy change with the number of observed Likes?
- Using a subsample (n = 500) of users for whom at least 300 Likes were available, ran predictive models based on randomly selected subsets of Likes.
- Even knowing a single random Like for a given user can result in nonnegligible prediction accuracy. Knowing further Likes increases the accuracy.

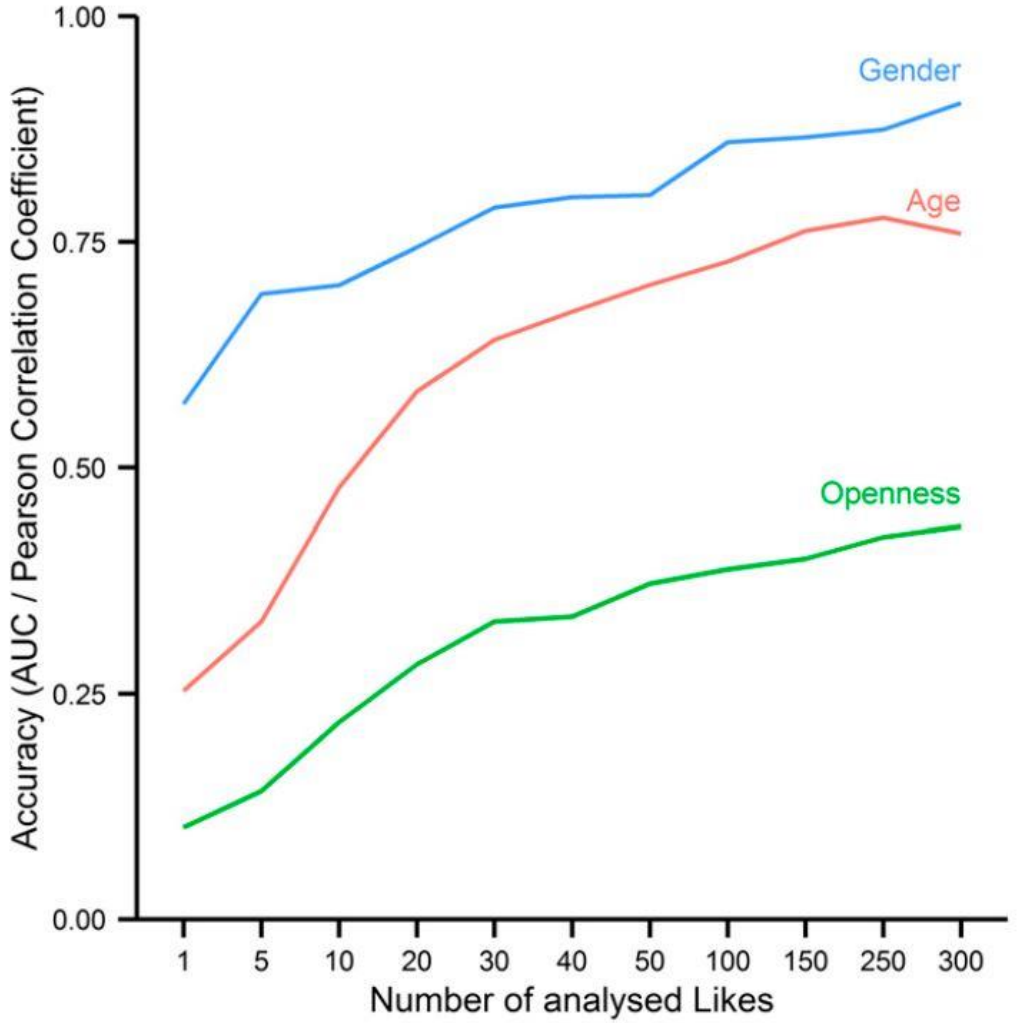

Fig. 4

Predictive power of Likes

Trait		Selected most predictive Likes		
IQ	*High*	The Godfather	Jason Aldean	*Low*
		Mozart	Tyler Perry	
		Thunderstorms	Sephora	
		The Colbert Report	Chiq	
		Morgan Freemans Voice	Bret Michaels	
		The Daily Show	Clark Griswold	
		Lord Of The Rings	Bebe	
		To Kill A Mockingbird	I Love Being A Mom	
		Science	Harley Davidson	
		Curly Fries	Lady Antebellum	
Religion	*Christian*	The Bible	I'm A Muslim & I'm Proud	*Muslim*
		Jesus Daily	Hadith Of The Day	
		I'm Proud To Be Christian	I Love Islam	
		God	I Need Allah In My Life	
		Jesus Christ	Prophet Muhammad Saw The Greatest Man In History	
		Church	Remove Group Fuck Islam From Facebook	
		The Holy Bible	Nancy Ajram	
		I Love Jesus	Moozlum The Movie	
		Christian Music	Desihits.Com	
		Gospel Music		

Table S1

Predictive power of Likes

- Few users were associated with Likes explicitly revealing their attributes.

For example, less than 5% of users labeled as gay were connected with explicitly gay groups, such as “Gay Marriage,” Consequently, predictions rely on less informative but more popular Likes, such as “Britney Spears” or “Desperate Housewives”.

Conclusion

- A wide variety of people's personal attributes can be automatically and accurately inferred using their Facebook Likes.
- Positive implications: improve numerous products and services.
- Negative implications: can easily be applied to people without their consent and notice, negatively affect people's experience of digital technologies, decrease their trust in online services.

Thank you