Using AI to combine data from satellites, low-cost sensors, and reference sensors

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IQAir and air quality data

- Mission: bring real-time air quality information to people everywhere
- Engage governments and communities
- Most downloaded air quality app:
 - 4.7 stars on Google Play
 4.8 stars on App Store



- 2020 World Air Quality Report issued with Greenpeace
- Official provider of air quality data for the UN Environmental Programme



IQAir's air quality data goals

- Reliable and accurate data
- Understandable data
 - Provide context
 - Visual
 - Examples:
 - Map: flow of pollution, fires <u>www.iqair.com/air-quality-map</u>
 - AirVisual app: visuals, clear instructions





Challenges with air quality data (1/2)

Satellite imagery and modeling

- Inaccurate for some regions
- Column measurements are **not** representative of what people breathe at ground-level
- Provides pollution composition
- Not real-time involves data modeling





Challenges with air quality data (2/2)







Low-cost sensors

- Real-time
- Limitations for accuracy
 - Humidity
 - Temperature
 - Particle composition
- Data outliers

Reference sensors

- Highly accurate (gold standard)
- Not real-time (problematic during wildfires)
- Limited spacial distribution





Platform machine learning

Input

- 6 years of:
 - Global air quality data from reference sensors
 - Satellite data
 - Weather data
 - Fire data
- 5 years of low-cost sensor data
- Collocation of low-cost and reference sensors

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Output

- Find patterns in the data: weather (temp, hum, pressure, winds), pollution composition, low-cost sensor impact
- Machine learning system to:
 - Validate sensor data
 - Calibrate low-cost sensors
 - Adjust satellite data
 - Compute forecast

Results

- Great visuals to make air quality understandable:
 - Air quality maps that provides context <u>www.iqair.com/air-quality-map</u> <u>www.iqair.com/earth</u>
 - App that provides important health recommendations
- High accuracy air quality data provided to millions of people

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AirVisual Earth

12:13 1

Carte

12:221

19

136

194

26



Learnings

- Government sensors need to be validated too
- Low-cost sensors need to be validated AND calibrated based on several parameters: pollution composition, temperature, humidity
- Satellite data and modeling are just models they do not reliably match the reality on the ground

Remaining Challenges

- Ground sensors are a MUST to get reliable data, need massive global deployment of low-cost sensors
- Some government sensors are not updating in real-time and thus, are inconsistent with real-time data from low-cost sensors
- Many populations lack real-time air quality necessary to safeguard health

