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
      www.iqair.com/air-quality-map
    - AirVisual app: visuals, clear instructions
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

**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
    www.iqair.com/air-quality-map
    www.iqair.com/earth
  • App that provides important health recommendations

• High accuracy air quality data provided to millions of people
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