

# Forecasting and demand planning

We're front runners on forecasting accuracy and we help you make smarter and faster buying decisions to help you avoid overproduction and lost revenue caused by stock-outs. Enhance gut-feeling with easy-accessible data insights at hand, whenever you need them

The image displays several overlapping UI cards representing data insights:

- Sales & forecast:** Shows current revenue of €345k (up 4% above target) and expected revenue of €382k (+13.5% last 30 days). Includes a line chart with a blue dot on a dashed trend line.
- Predicted sales:** A table showing units for different time periods:

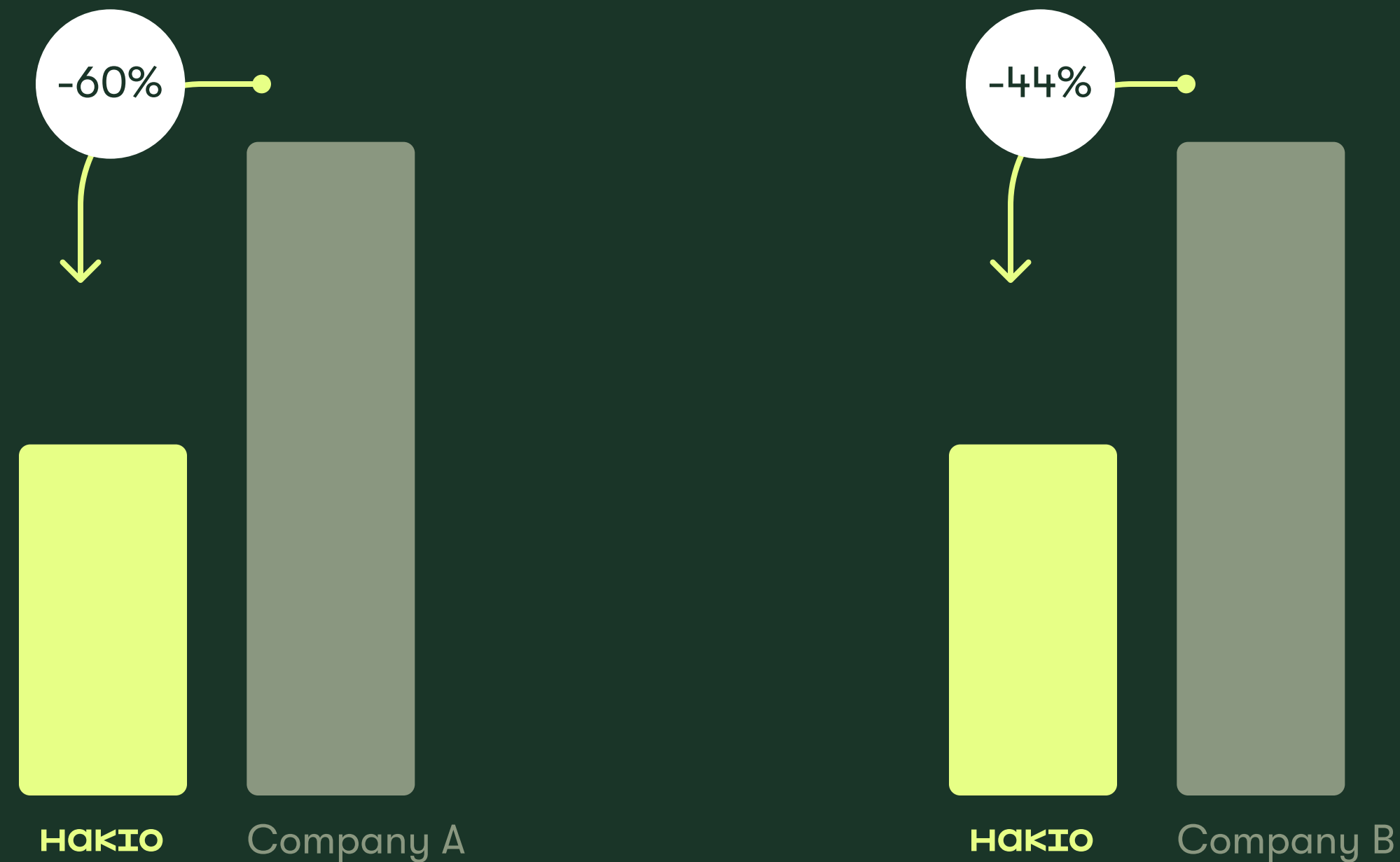
Period	Units
0 - 30 DAYS	145
30 - 60 DAYS	234
60 - 90 DAYS	303
- Product Details:** Features an image of a puffer jacket, a 'Soon out of stock' warning, location 'CX warehouse', and SKU '#20241'. A prominent 'Add to PO' button is at the bottom.

# We enhance forecasting accuracy using machine learning algorithms

Our forecast use machine learning to go beyond the accuracy of standard demand forecasting algorithm. We use 30-70 attributes to capture abnormalities in markets and trends to provide actionable insights. We combine prediction models via data-driven model weighting (ensemble modelling) to ensure the best performing forecasts for all SKUs at all times

## Enterprise Customer Results

Customer estimate a €100m inventory reduction from using Hakio forecasting models across all brands



Forecast error (MAPE) evaluated by planners

## How the new process impacts the planning department

- Standardizing the process for 30 Planners, that wil work in a uniform way in the future
- Debiasing decisions to remove personal preference and subjective judgement.

Hakio help companies **stock the right quantities** at the right times while eliminating manual non-value-adding work

The screenshot displays the Hakio software interface for a product named "Runners dream backpack". The interface is divided into several sections:

- Product Overview:** Shows the product name "Olive Green", a photo of the backpack, and key details:
  - STYLE: HK24249003
  - UNIT COST: 30.00€
  - PLANNER: Jens Nielsen
  - CLASS: A
- Forecast table:** A table showing sales and forecast data across weeks. The "NOW" tab is selected.
 

HAKIO FORECAST	HISTORIC			NOW							
WEEK NUMBER	WEEK 44	WEEK 45	WEEK 46	WEEK 47	WEEK 48	WEEK 49	WEEK 50	WEEK 51	WEEK 52	WEEK 1	
Sales & forecast	7.200	7.200	7.200	7.200	7.200	7.200	7.200	7.200	7.200	7.200	
Forecast 1 lead time ago	7.200	7.200	7.200	7.200	7.200	7.200	7.200	7.200	7.200	7.200	
Last year sales	7.200	7.200	7.200	7.200	7.200	7.200	7.200	7.200	7.200	7.200	
Closing stock	76.475	76.475	76.475	76.475	76.475	76.475	76.475	76.475	76.475	76.475	
Suggested orders	2.273	2.273	2.273	2.273	2.273	2.273	2.273	2.273	2.273	2.273	
Weeks on hand	↑ 8,7	↑ 8,7	↑ 8,7	↑ 8,7	↑ 8,7	↑ 8,7	↑ 8,7	↑ 8,7	↑ 8,7	↑ 8,7	
- Forecast settings:**
  - START WEEK: 35
  - SEASONALITY PROFILE: Backpacks
  - ONLINE: A
  - RETAIL: C
  - WHOLESALE: C
- Comments:**
  - See forecast ... Ditte (08.09.23)
  - Adjusted ... Jens (06.09.23)
- Forecast graph:** A line chart showing "Forecast" and "Inventory" over time. The y-axis ranges from 40 to 180. A tooltip for "FEB 27, 2022" shows "Actuals" at 70. The legend includes: PAST SALES (blue), CERTAINITY (green), FORECAST (grey), and ADJUST (light blue).

$$\text{Sales} = \sum a f(x) + \varepsilon$$

The machine learning models

The forecast error

Model weights

- Customer data
- Style data
- Engineered features

The diagram shows the equation Sales = Σ a f(x) + ε. Above the equation, 'The machine learning models' has a downward arrow pointing to the function f(x). 'The forecast error' has a downward arrow pointing to the error term ε. Below the equation, 'Model weights' has an upward arrow pointing to the coefficient 'a'. A list of inputs for f(x) has upward arrows pointing to the function: 'Customer data', 'Style data', and 'Engineered features'.

We maintain a library of models that we develop to solve different problems. When a new customer is onboarded we run all models and use out-of-sample analysis to weight each model and create a unique ensemble with relevant customer attributes. This allows for highly customised and advanced predictions without making any manual adjustments.

$$\text{Sales} = \sum \alpha f(x) + \epsilon$$

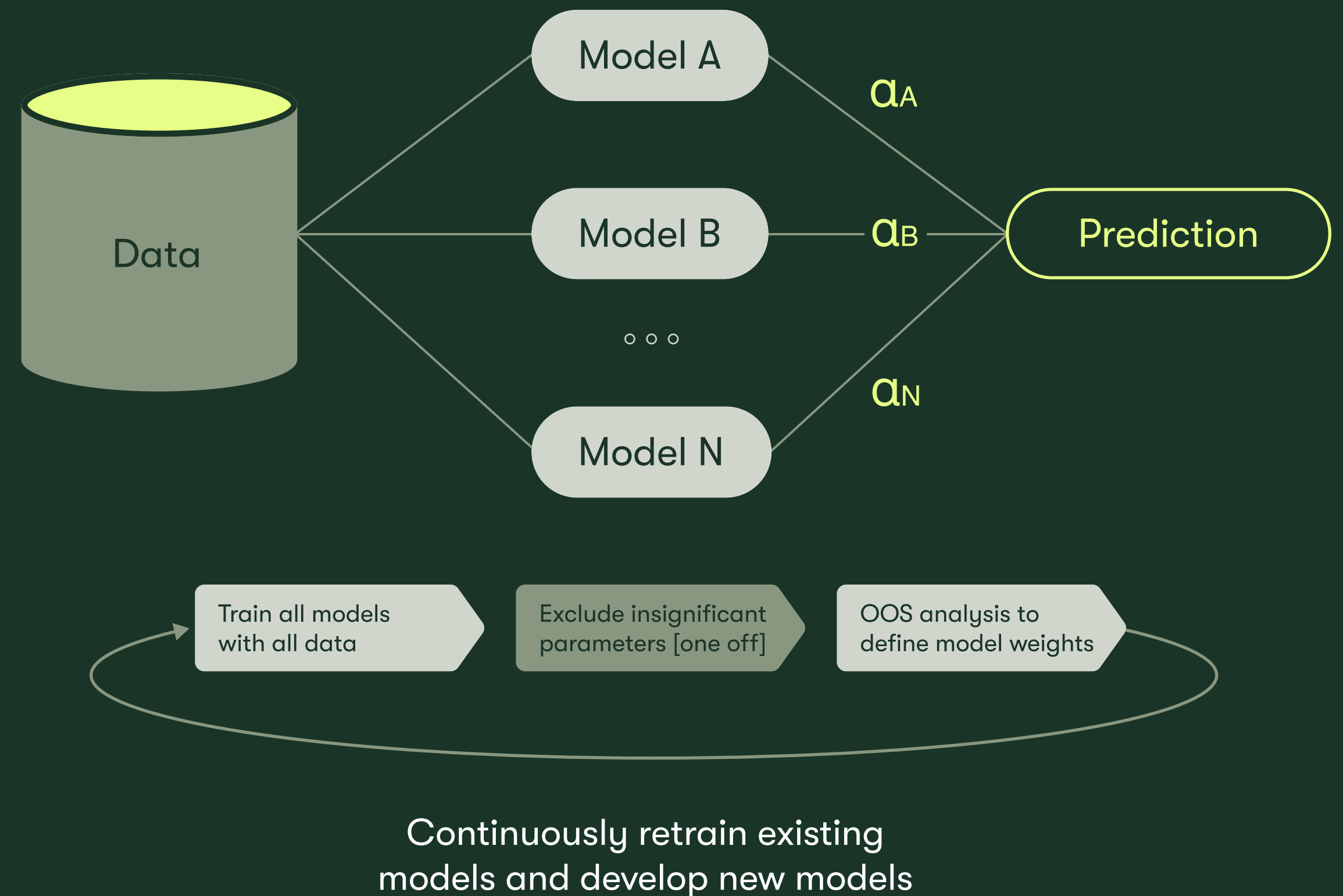
# Ensemble weights

When we talk about “the Hakio model” it's actually not a single model.

We maintain a library of models that we develop to solve different problems.

When a new customer is onboarded we run all models and use out of sample analysis to weight each model and create a unique ensemble with relevant customer attributes.

This is a unique feature that allows to produce much more advanced predictions without making any manual adjustments.



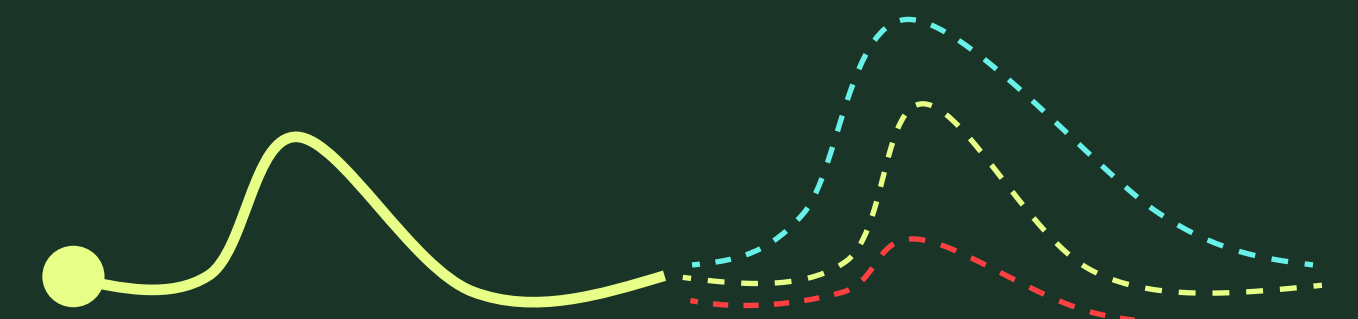
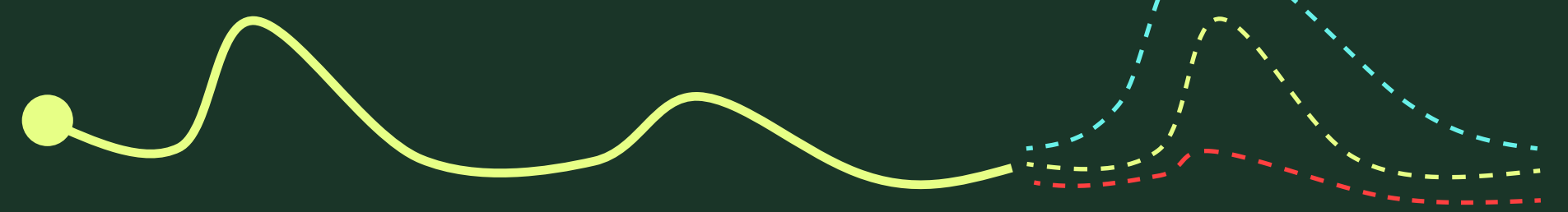
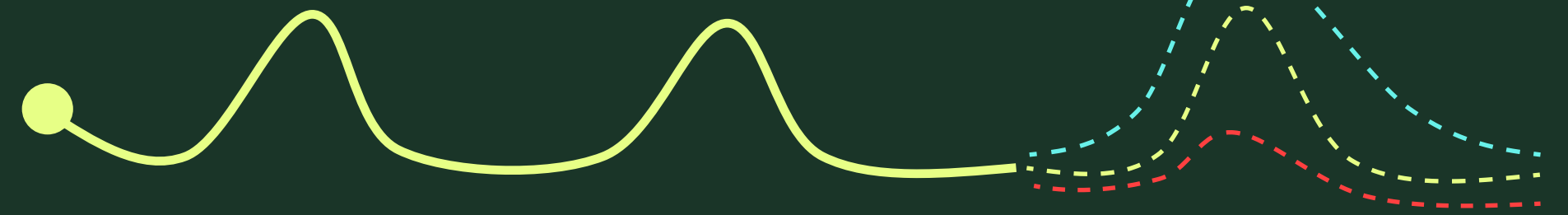
$$\text{Sales} = \sum \alpha f(x) + \epsilon$$

# A combination of best-in-class and tailor-made models

In addition to recognized best-in-class models, we also utilize our own models - making sure we capture all the dynamics that our customers count on!

These models are primarily based on machine learning, but we also leverage the best from econometric models. All the building takes place in python using libraries such as PyTorch, Pyro and the like.

One example is a hierarchical probabilistic model



Expected sales



Top 95% sales



Bottom 95% sales



Looking for the most  
accurate forecast  
possible?

**LET'S TALK**