Digimarc Recycle

Helping Brands Achieve Circularity

Product Overview

DIGIMARC

Sustainability Starts With Data-Driven Action

Recycling is Under Pressure

Over 2 billion tons of municipal waste is generated globally per annum and this number is expected to grow 70% by 2050[1]. Plastics represent more than 10% of total waste, and packaging is a significant contributor. Flexibles and rigid plastic packaging represent 44%[2] of the total packaging market but have significantly lower recycling rates than paper/card, metal, and glass. The widespread negative environmental impacts are profound.

60% of consumers are unsure how to recycle plastics, and it is estimated 86% of plastics are incinerated, leak into the environment, or end up in a landfill. Consequently, only 2% 'close the loop'.[3]

Many new initiatives and legislation has emerged, including the 'EU Green Deal' and PPWR, the 'New Plastics Economy', the Holy Grail initiative, the Circular Plastics Taskforce (CPT), and the EPA's National Recycling Strategy in North America. Many of the largest (CPG) companies have publicly committed ambitious targets to eliminate single-use plastics and increase the percentage of recycled plastics in their products and packaging.

Limitations in Today's Sortation

Sortation technologies such as visible/near-infrared (VIS/NIR) technology currently struggle to identify and sort by grad (e.g., food and non-food); many different types and formats of packaging (e.g., full-body sleeves, material additions) and plastic types (e.g., carbon black). In addition, current technology is unable to accurately attribute products that have been properly sorted back to the specific brand, stock-keeping unit (SKU), or more granular identifiers – limiting the data available for brands to improve the sustainability of their products and track progress in meeting their goals.

As a result of these limitations, the quality of recyclate is either uncertain or low, impacting its future value, and constraining brand owners trying to 'close the loop' and achieve circularity.

The Ecosystem is Complex

Due to the heterogenous nature of ecosystems across geographies, recycling initiatives are difficult to implement, creating obstacles for brands seeking a partner able to unlock their full potential.

The prize is huge.

Fortunately, a product is now available that can deliver tangible benefits for the many stakeholders wanting to make a positive impact.

Together We Can Drive Change

Digimarc Recycle represents a revolution in the sortation, and thus recycling, of plastic waste. By linking covert digital watermarks (used to deterministically identify plastic packaging to any desired level of granularity) with an extensible cloud-based repository of product attributes (such as brand, SKU, product variant, packaging composition, food/non-food use, etc.), Digimarc Recycle overcomes the limitations of today's optical sorting technologies to drive a step-change improvement in the quality and quantity of recyclate. Moreover, the same information used to drive this advanced sortation in facilities can be used to provide product-specific and location-based disposal instructions via a brand-owned direct-to-consumer digital communication channel accessed via on-pack watermarks or QR codes.

In addition to providing the information necessary to power advanced sortation at recycling facilities, Digimarc Recycle captures and provides a holistic view of the post-purchase product journey benefitting stakeholders across the value chain. Producer Responsibility Organizations (PROs) can design and implement more meaningful and more accurate EPR schemes, facility operators can unlock operational efficiencies and insights, and brand owners and retailers can access data to power design-for-recyclability improvements, packaging-usage reductions, consumer behavior insights and overall operational gains.

Digimarc Recycle enables brands to start digitizing their products for greater sustainability and circularity.

Watch how Digimarc can help here

DIGIMARC

1. World Bank 2. Statista 3. McKinsey: New Plastics Economy

Overview: How Does Digimarc Recycle Work?

Digitize

Create a **digital twin** for a physical item in the Digimarc Illuminate platform.

The Digimarc Illuminate platform fully supports open industry standards in addition to providing easy integration with enterprise software systems, streamlining the process for all stakeholders to capture the key data/ attributes regarding the composition of the packaging item.

Enhance

Generate **digital watermarks** in the Digimarc Illuminate platform to link the physical product to its digital twin.

Digital watermarks are covert and applied into the artwork of product labels (2D) without the need for special inks or printing processes, or into the substrate of packaging (3D) without the need for any additives or special manufacturing processes, using Digimarc enhancement tools provided to supply chain partners.

Sort

Digimarc **detection software** embedded in the sortation machinery found in waste and recycling facilities, enables deterministic identification of watermarked items based in the waste stream, based on their composition.

This leads to more intelligent and accurate sortation, improving the quantity and quality of recyclate.

Analyze

Individual stakeholders have access to a dynamic analytics dashboard providing each stakeholder with relevant and **powerful data/insights** to help them optimize and proactively improve their activities.

Users can also export data, schedule reports, or integrate the data seamlessly into their business intelligence architecture to ensure key data is always where it needs to be.

Engage

Brands can also leverage **Digimarc Engage** as part of Digimarc Recycle - generating QR codes in Digimarc Illuminate for a Digital Twin, then configuring redirection rules for different digital experiences depending on the context in which consumers scan the product.

Engage can be used for many different use cases, some of which strongly support Digimarc Recycle, including informing the consumer exactly how and where to recycle the product, educating consumers about ESG initiatives, or incentivizing recycling activity.

Contact us to learn more.

DIGIMARC

Digitize: Digital Twins Give a Physical Product a Digital Life

Digital Twin

Digimarc Illuminate Platform

ID (GTIN, Circularity ID, Other)

Product and Packaging Metadata

Products and product packaging have many characteristics which can be represented as data. Some of this data exists today and it is used cross-functionally in the supply chain and complies with open standards.

Other data has yet to follow the standards and is stored disparately in various enterprise systems; not yet realizing its full potential.

A digital twin is the digital representation of a physical or digital item in the Digimarc Illuminate platform. Digital twins can represent items at any desired level of granularity (class, SKU, batch/lot, or serialized). The digital twin carries key data about the product and its packaging components.

For recycling, this is likely to include data regarding material, type (e.g., food grade), composition (e.g., monolayer, transparent, etc.), and other key attributes that assist in accurate sortation. There is no limit to what or how many attributes can be carried by the digital twin, helping enable a more circular economy now and in the future. Digimarc supports all industry driven standards, current and future, by providing easy ingestion of data from – and publishing of data to – any source so desired.

Product Digitization Workflow

Brands and their upstream suppliers (premedia agencies, printers, converters, etc.) create an account in the Digimarc Illuminate platform.

Users can be added to each account with rules for accessibility, administration, and security.

A flexible product hierarchy structures the data in layers from raw materials to subcomponents to finished goods.

Each supplier in the value chain can input the relevant metadata (e.g., from the packaging components) for the digital twin, following established open standards where available.

This process is streamlined, as the Digimarc Illuminate platform supports both manual data input as well as bulk upload functionality or integration via API.

A parent-child relationship is established between the product and its bill of materials (BOM)/ packaging components so recycling data can be attributed at brand and SKU level.

Suppliers/partners responsible for printing/manufacturing are granted access to the data they need in the Digimarc Illuminate platform and can create watermarks to enhance packaging.

DIGIMARC

Enhance: Digital Watermarking

Flagship Digimarc technology enables product digitization when security, robustness, redundancy, and covertness matter.

Secure, covert watermarks applied to the artwork (2D) or substrate (3D) of packaging.

Approximately thumbnail-sized codes that cover the surface of the item to ensure robust detection and readability.

Is it easy to implement? What changes are required?

- For 2D watermarking in packaging artwork, no special inks or printing processes are required; watermarks use existing pixels in the artwork.
- For 3D watermarking in packaging substrate, no additives or special manufacturing processes are required.
- Watermarks are often added during packaging and mold updates to reduce deployment complexities and cost; however, existing artwork files and molds can be easily updated, as well.
- Digimarc enhancement tools enable premedia, press, and converter partners to autonomously implement the technology at scale for their brand customers.
- Digimarc maintains strong partner relationships with all the leading premedia agencies and converters; new partners receive comprehensive training and support to enable them to support brands' needs.
- Digimarc works with its partners to create enhancement strategies (e.g., brand guidelines) which streamline the process and make enhancement easier, faster, and cost efficient.
- Digimarc provides software plugins that generate watermarks and integrate them into graphics or tool designs to help enable the brands' existing supply chain to implement watermarking in the artwork file.

How is the watermark reliably read?

- Digimarc detection technology can be embedded into any device with a camera and a processor (such as industrial machinery, point-of-sale technology, etc.), and leveraged by mobile applications to decode digital watermarks.
- Each tile has an error correction area for redundancy in the case of damage, and pieces of multiple tiles can be combined to recover a signal.

What types of items can be watermarked?

- Anything that is digitally processed or made from something digitally processed.
- Uniquely versatile: can be applied to both physical & digital items.

DIGIMARC

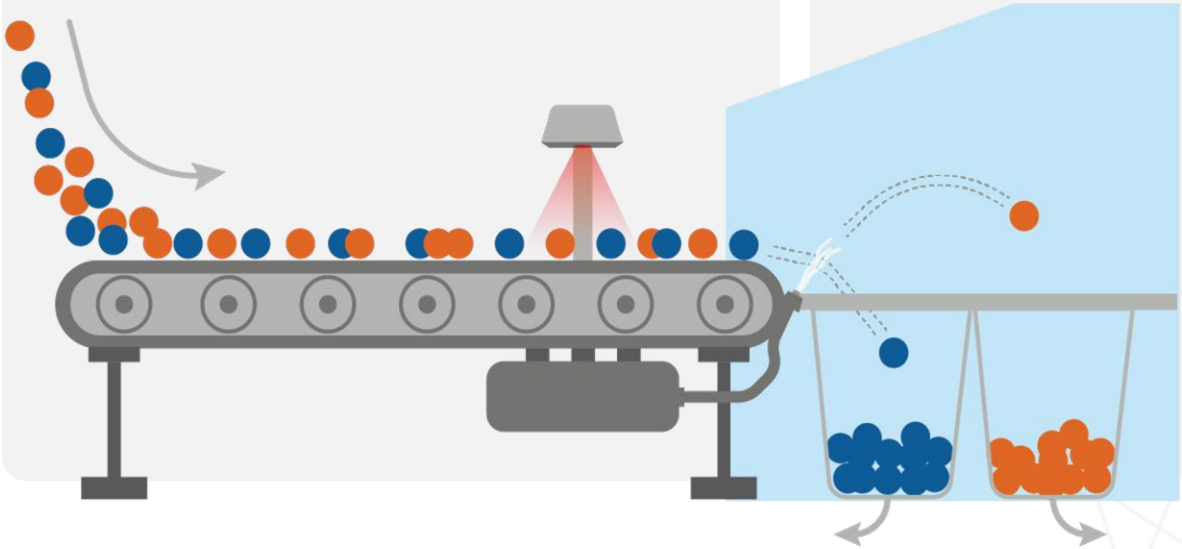
Sort: Overcome the Limitations of Today's Technology

1. Product packaging connected to its digital twin

2. Product packaging enters recycling/waste facility

3. Digimarc detection technology embedded in sortation equipment

4. Cameras identify packaging by capturing secure digital watermark



5. Digimarc delivers sorting instructions based on facility operator rules

6. Unprecedented sorting accuracy and granularity

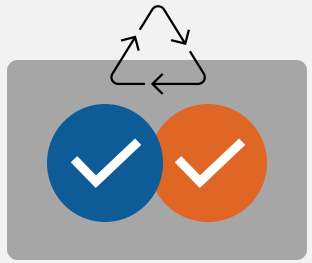


Illustration source: TOMRA

Sort: Industry Tested and Validated

125,000 TOTAL ITEMS * 250+ SKUs

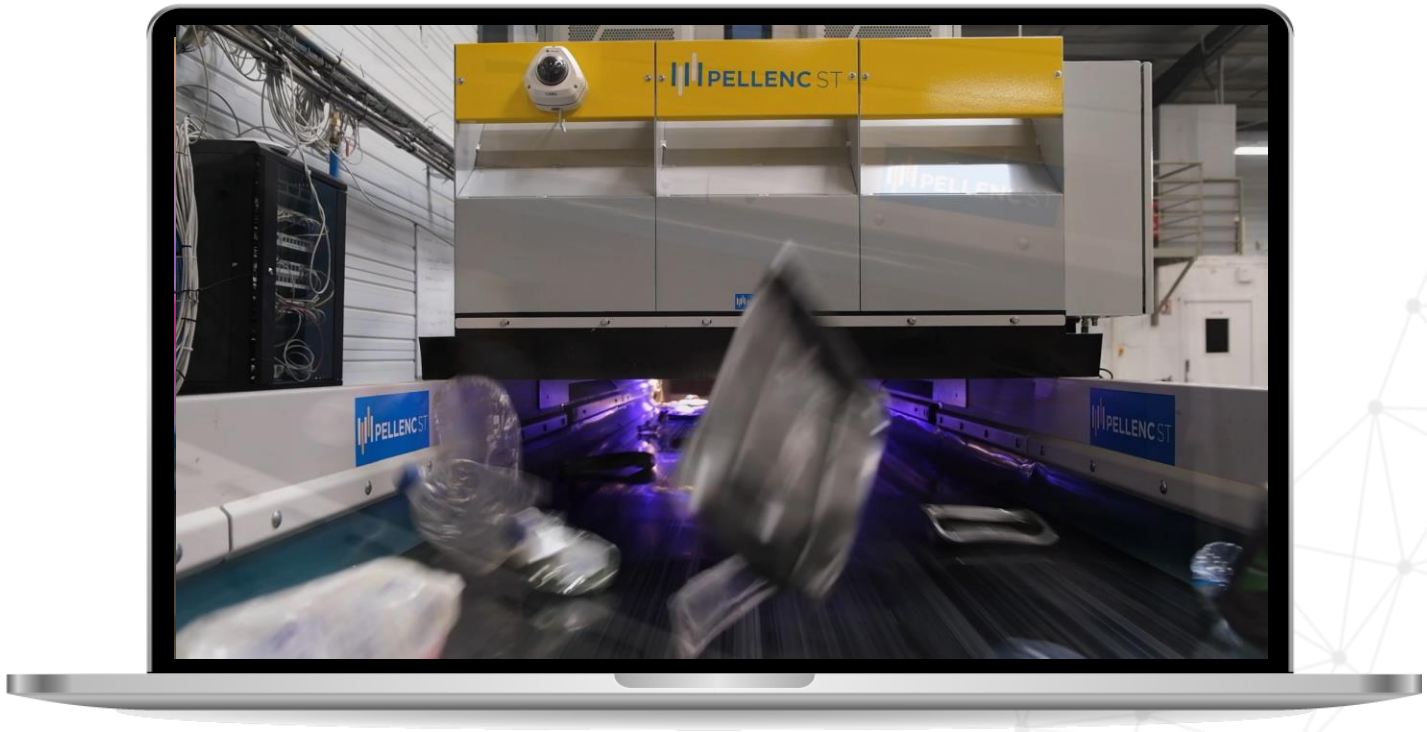
Consistent high performance across all tested categories of plastic packaging material

Pellenc ST Module*

99% detection rates
95% ejection rates
95% purity rates

TOMRA Module**

99% detection rates
96% ejection rates
93% purity rates



*Average results across PP, PE, PET, and Flexible plastics READ AIM/AEPW Press Release

** Average results across PP, PET, Fibre, and Flexible plastics READ AIM/AEPW Press Release

DIGIMARC

Analyze: Unlock Never-Before-Seen Insights

Every item's **interaction with a consumer or sortation machine** is captured by our platform, increasing your digital twin's intelligence.

Recycling data by brand, SKU, geography, material, package type, and more.

Post-consumption data to understand product lifespan and consumer behavior.

Campaign data to identify which content and campaigns achieve reach and deliver impact.

Consumer engagement data showing where, when, and why consumers engage with products.

Custom dashboards

Data export

Scheduled reporting

Integrations into BI architecture

Secure, configurable **data access controls**, ensuring privacy and equipping all stakeholders with the most relevant layer of data and insights

DIGIMARC

The Advantages of Acting Now for Brands & Retailers

Harness the power of data…

Lead the ESG Charge

- Measure real lifecycle **environmental impacts** and prove recyclability in practice
- Use data to report progress on your most challenging **circularity commitments**
- Grow **stakeholder trust** based on proven outcomes and concrete data
- Tell customers your sustainability story and **demonstrate leadership**
- Protect and **win market share**

Optimize the Business

- Understand usage, time, and location throughout the **product lifecycle**
- **Optimize package design** for recyclability and reduce BOM
- Leverage improved recyclate quality and quantity to increase the percentage of recycled plastic in products and packaging, helping you **reach your goals**
- Start your product digitization journey and begin **compounding value**

Fuel Marketing

- **Measure impact** and optimize marketing/promotional campaigns
- Leverage QR codes on product packaging as a new **direct-to-consumer (D2C) communications** and ecommerce channel
- **Share recycling information** and incentivize consumer participation
- **Build and reward** loyal customers

DIGIMARC

Benefits for Important Stakeholders

Digimarc Recycle unlocks additional benefits to important ecosystem participants to incentivize their adoption and drive impact.

Sortation Equipment Manufacturer

- Expand sortation capabilities to include more material types and packaging formats
- Differentiate from competitors by helping facilities improve quality and quantity of sort
- Create new data-driven services for facility operators

PRO

- Drive more meaningful, data-driven EPR schemes
- Gain system insights by harnessing novel data
- Reduce audit costs and free riders, including cross-border

Facility Operator

- Gain granular insights and holistic oversight of your day-to-day operations
- Increase quality, value, and applications for PCR, improving your top line
- Reduce waste diverted to landfill or incineration, and improving the environmental impact.

End Consumer

- Uncover clear guideline information on how and where to recycle
- Access clear recyclability data to support responsible purchasing
- Get peace of mind that behavior can contribute to change

DIGIMARC

Want More?

The Digimarc team is standing by to answer questions, go over pricing and help scope out an initial project.

CONTACT US

DIGIMARC