Dress-ED: Instruction-Guided Editing for Virtual Try-On and Try-Off

Davide Lobba[1,3*], Fulvio Sanguigni[2,3*], Bin Ren[4†], Marcella Cornia[2], Rita Cucchiara[2], and Nicu Sebe[1]

[1] University of Trento, Italy
{davide.lobba, nicu.sebe}@unitn.it
[2] University of Modena and Reggio Emilia, Italy
{fulvio.sanguigni, marcella.cornia, rita.cucchiara}@unimore.it
[3] University of Pisa, Italy
[4] MBZUAI, United Arab Emirates
bin.ren@mbzuai.ac.ae

aimagelab.github.io/Dress-ED/

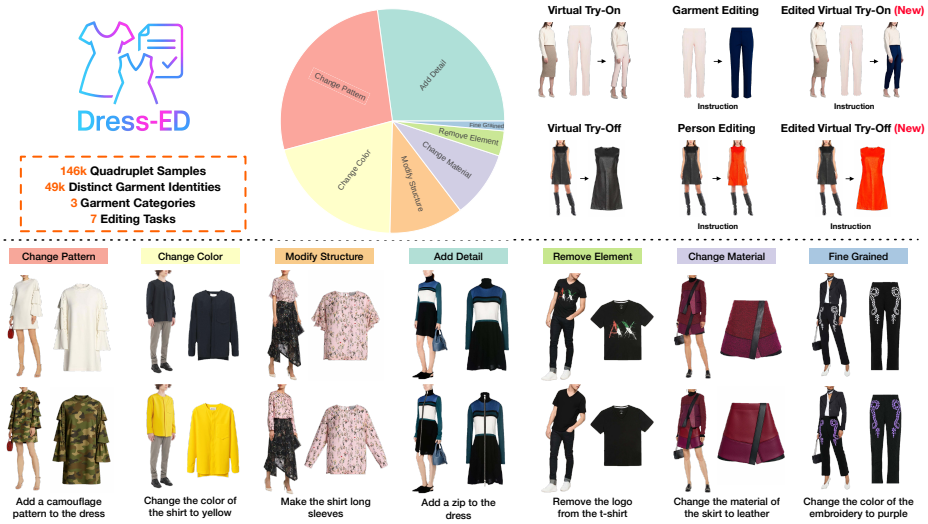

Fig. 1: We propose the **Dress Editing Dataset** (**Dress-ED**), the first benchmark for instruction-driven virtual try-on and try-off with over 146k verified samples across seven editing types, including both appearance and structural modifications.

Abstract. Recent advances in Virtual Try-On (VTON) and Virtual Try-Off (VTOFF) have greatly improved photo-realistic fashion synthesis and garment reconstruction. However, existing datasets remain static, lacking instruction-driven editing for controllable and interactive fashion generation. In this work, we introduce the **Dress Editing Dataset** (**Dress-ED**), the first large-scale benchmark that unifies VTON, VTOFF, and text-guided garment editing within a single framework. Each sample in Dress-ED includes an in-shop garment image, the corresponding

* Equal contribution. † Corresponding author.

person image wearing the garment, their edited counterparts, and a natural-language instruction of the desired modification. Built through a fully automated multimodal pipeline that integrates MLLM-based garment understanding, diffusion-based editing, and LLM-guided verification, Dress-ED comprises over 146k verified quadruplets spanning three garment categories and seven edit types, including both appearance (*e.g.*, color, pattern, material) and structural (*e.g.*, sleeve length, neckline) modifications. Based on this benchmark, we further propose a unified multimodal diffusion framework that jointly reasons over linguistic instructions and visual garment cues, serving as a strong baseline for instruction-driven VTON and VTOFF.

Keywords: Virtual Try-On · Virtual Try-Off · Editing · Fashion

1 Introduction

Digital garment manipulation on human images has emerged as a central challenge at the intersection of computer vision, computer graphics, and fashion intelligence. Tasks such as Virtual Try-On (VTON) [20, 31, 37] and Virtual Try-Off (VTOFF) [34, 48] aim to bridge physical garments and digital humans through realistic cross-modal synthesis and reconstruction. Recent progress in diffusion-based generation [4, 9, 70] and Transformer architectures [24, 26, 30] has achieved remarkable realism. Nevertheless, existing datasets remain largely static, containing fixed person-garment pairs without support for instruction-level control or semantic supervision, thereby constraining progress toward interactive and controllable fashion manipulation.

Beyond conventional VTON and VTOFF, emerging applications demand fine-grained garment editing, such as modifying color, texture, or silhouette via natural-language instructions. Achieving this requires precise alignment between garment semantics, human appearance, and linguistic intent. Yet, the existing efforts remain fragmented: *(i)* VTON datasets [8, 20, 37] focus on person–garment synthesis without editability; *(ii)* instruction-driven datasets [6, 23, 64, 67] support generic image editing but lack consistent garment–person correspondences; and *(iii)* fashion editing approaches [22, 62, 69] tackle narrow sub-tasks without unified benchmarks. As a result, controllable, multimodal fashion editing remains underexplored.

Motivated by these limitations, in this work we propose a unified benchmark for instruction-driven fashion editing that jointly captures garment semantics, human appearance, and editing intent. To this end, we introduce the **Dress Editing Dataset** (**Dress-ED**), the first large-scale, systematically curated benchmark that integrates VTON and VTOFF tasks under a single instruction-based framework. Each sample in Dress-ED includes an in-shop garment image, the corresponding person image wearing the garment, their edited counterparts, and a natural-language instruction describing the desired modification (Fig. 1). The dataset is constructed through a fully automated multimodal pipeline. In particular, the pipeline first extracts structured garment attributes using Qwen3-

VL [2], then synthesizes diverse editing instructions and applies diffusion-based editing via FLUX.2 Klein [27]. Finally, multi-stage quality verification with GPT-5 [38] and a fine-tuned InternVL-3.5 [51] ensures semantic consistency and visual fidelity. The resulting dataset comprises over 146k verified samples spanning three garment categories and seven editing types, covering both *appearance edits* (*e.g.*, color, pattern, material) and *structural modifications* (*e.g.*, sleeve length, neckline, details). Dress-ED thus establishes a scalable and semantically grounded benchmark for controllable, instruction-driven fashion generation.

In addition to dataset construction, Dress-ED contributes along two key dimensions: *benchmarking* and *methodology*. It introduces two complementary benchmarks (*i.e.*, instruction-driven VTON and VTOFF) under unified evaluation protocols assessing both visual realism and semantic edit accuracy. Building on this foundation, we propose a unified multimodal diffusion framework for instruction-driven editing in both try-on and try-off scenarios. The framework integrates a pretrained MLLM, a lightweight connector, and a DiT-based component [43] to jointly reason over textual instructions and visual garment cues. This design enables fine-grained, localized edits through token-level conditioning while preserving global semantic coherence, providing a strong and extensible baseline for future research in multimodal fashion understanding and generation.

Contributions. Our main contributions are threefold:

- We present Dress-ED, the first large-scale dataset that unifies VTON, VTOFF, and instruction-driven garment editing within a single, semantically consistent framework.
- We develop a fully automated multimodal pipeline that combines MLLM-based garment understanding, diffusion-based synthesis, and LLM-guided verification, generating over 146k high-quality samples across diverse edit types.
- We establish comprehensive benchmarks and a unified diffusion-based baseline for instruction-driven fashion editing in both VTON and VTOFF settings.

2 Related Work

Virtual Try-On and Try-Off. VTON aims to synthesize realistic images of a target person wearing a given garment [3, 11, 14, 45], while VTOFF addresses the inverse process of recovering clean garment representations from dressed-person photos for digitization and editing. Early *warping-based* methods [7, 20, 50, 56, 58] deform garments to align with body shapes but often suffer from misaligned textures and ghosting artifacts. Recent *warping-free* models [4, 9, 36, 70] remove explicit deformation by using attention-based conditioning, achieving higher realism though sometimes losing fine texture fidelity. To mitigate this, approaches based on diffusion-based architectures [24, 26, 30, 69] enhance garment details, while conditioning modules such as LOTS [18] and LEFFA [68] improve structural consistency. In parallel, diffusion-based VTOFF models [34, 48, 49, 55] advance garment disentanglement from occlusions and complex poses across multiple categories. More unified frameworks like Voost [28], One-Model-for-All [32], and

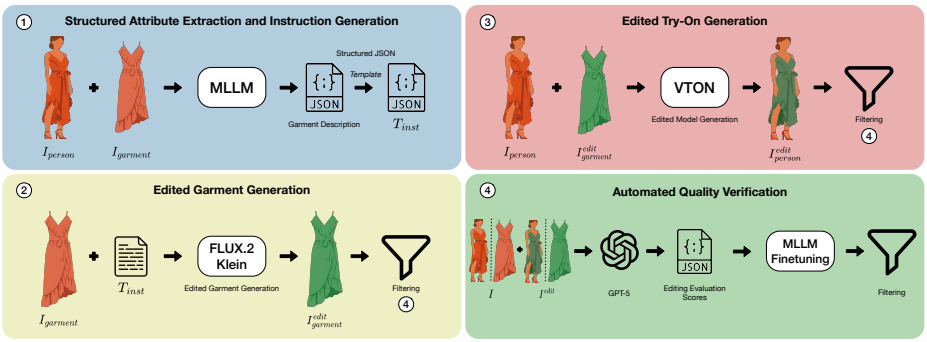

Fig. 2: Overview of the Dress-ED curation pipeline. Starting from Dress Code [37], (i) structured garment attributes are extracted with Qwen3-VL and used to generate natural-language edit instructions, (ii) edited in-shop garments are synthesized via FLUX.2 Klein, (iii) the corresponding edited try-on images are generated using FitDiT, and (iv) all results are validated through a version of InternVL-3.5, fine-tuned with samples annotated using GPT-5 [38], to ensure semantic and visual consistency.

Any2AnyTryon [19] attempt to integrate both VTON and VTOFF within a single model. However, the progress of such unified modeling remains limited by the lack of large-scale datasets that jointly support person-centric synthesis and garment-centric reconstruction with fine-grained correspondence. Motivated by this gap, we introduce a large-scale dataset that unifies both VTON and VTOFF tasks, enabling detailed garment editing and realistic human-garment interaction beyond prior approaches.

General-Purpose Editing. Image editing has become an active research area, enabling flexible and fine-grained manipulation of image content. Existing approaches can be broadly categorized into several types. Finetuning-based methods [6, 15, 33, 47, 53, 59, 63, 64, 66] adapt pretrained generative models using real or synthetic supervision. Some studies [15, 33] further incorporate MLLM guidance to inject richer multimodal cues. Other research lines explore zero-shot editing via noise or flow inversion [16, 25, 41, 46] and probing-based analysis to identify edit-receptive components [1]. However, these general-purpose methods often underperform in fashion scenarios, where garments exhibit complex geometry, layered structure, and fine-grained textures that require precise spatial and semantic control. Recently, foundation models such as FLUX.2 Klein [27] and Qwen-Image-Edit [54] have advanced instruction-based image-to-image editing, supporting diverse manipulation tasks. Yet, these models remain limited when the input and target belong to different domains (*e.g.*, person-to-garment or garment-to-person transformations).

Fashion-Oriented Editing. In the VTON setting, several methods have explored instruction-based editing as an auxiliary task. M&M VTO [69] and HieraFashDiff [57] demonstrate qualitative results on simple edits such as rolled sleeves. However, these works neither provide quantitative benchmarking nor address more challenging edits involving complex structures or patterns. In the

Algorithm 1 Automated Multimodal Data Generation.

Require: Paired samples $\{(I_{\text{garment}}, I_{\text{person}})\}$ from Dress Code [37]
Ensure: Verified quadruplets $\mathcal{S}^* = \{(I_{\text{garment}}, I_{\text{person}}, I^{\text{edit}}_{\text{garment}}, I^{\text{edit}}_{\text{person}}, T_{\text{inst}})\}$
Stage 1: Attribute Extraction and Instruction Generation
$\mathcal{A}_g \leftarrow \text{Qwen3-VL}(I_{\text{garment}}, I_{\text{person}})$ ▷ structured garment attributes
$T_{\text{inst}} \leftarrow f_{\text{temp}}(\mathcal{A}_g)$ ▷ template-based edit instruction
Stage 2: Diffusion-Based Garment Editing
$I^{\text{edit}}_{\text{garment}} \leftarrow \text{FLUX.2 Klein}(I_{\text{garment}}, T_{\text{inst}})$ ▷ apply appearance/structure edit
Stage 3: Try-On Image Generation
$I^{\text{edit}}_{\text{person}} \leftarrow \text{FitDiT}(I_{\text{person}}, I^{\text{edit}}_{\text{garment}})$ ▷ render edited garment on person
Stage 4: LLM-Guided Quality Verification
$s \leftarrow \text{GPT-5Judge}(I, I^{\text{edit}}, T_{\text{inst}})$ ▷ adherence & quality scoring
$f_{\text{verifier}} \leftarrow \text{Finetune}(\text{InternVL-3.5}, \{(I, I^{\text{edit}}, T_{\text{inst}}, s)\}_{\sim 5\text{k}})$
$\mathcal{S}^* \leftarrow \{(I_{\text{garment}}, I_{\text{person}}, I^{\text{edit}}_{\text{garment}}, I^{\text{edit}}_{\text{person}}, T_{\text{inst}}) \mid f_{\text{verifier}}(I, I^{\text{edit}}, T_{\text{inst}}) > t\}$
return $\mathcal{S}^*$ // ∼146k verified samples, 3 categories, 7 edit types

broader fashion editing domain, recent efforts focus on either person-to-person [22] or garment-to-garment [62] transformations. T-FIT [22] guides the model using concept vectors derived from CLIP text embeddings and fine-tunes it via LoRA [21] to preserve non-instructional visual attributes. EditGarment [62] constructs synthetic pairs of original and target garments with corresponding textual captions and trains an InstructPix2Pix [6] model for garment-level editing. Despite these advances, no existing approach can jointly perform VTON or VTOFF and instruction-driven editing within a unified framework. Moreover, the lack of a reliable benchmark with ground-truth supervision limits consistent evaluation of edit quality and semantic fidelity. Our proposed Dress-ED bridges these gaps by unifying VTON, VTOFF, and instruction-based editing for dedicated model training and evaluation.

3 Dress Editing Dataset (Dress-ED)

We introduce the **Dress Editing Dataset** (**Dress-ED**), a large-scale benchmark unifying instruction-driven fashion editing for both VTON and VTOFF. Dress-ED extends Dress Code [37] by adding natural-language editing instructions and corresponding edited images, aligning textual intent with visual garment semantics. Each sample supports *appearance* edits (*e.g.*, color, pattern, material) and *structural* edits (*e.g.*, sleeve length, neckline, details), enabling fine-grained and controllable garment manipulation. This unified formulation provides a comprehensive benchmark for evaluating and training instruction-guided fashion editing models.

3.1 Automated Dataset Generation Pipeline

We construct Dress-ED through a fully automated multimodal pipeline, summarized in Alg. 1 and illustrated in Fig. 2, which converts static garment–person pairs into instruction-driven editing samples. Built upon the Dress Code dataset [37], which contains paired images $(I_{\text{person}}, I_{\text{garment}})$ across three representative clothing types (*i.e.*, upper-body, lower-body, and dresses), the pipeline integrates

multimodal understanding, diffusion-based generation, and LLM-guided verification to produce coherent instruction-grounded samples. Each finalized instance in Dress-ED is formulated as:

$$\mathcal{S} = \left(I_{\text{garment}},\, I_{\text{person}},\, I^{\text{edit}}_{\text{garment}},\, I^{\text{edit}}_{\text{person}},\, T_{\text{inst}}\right), \tag{1}$$

where $(I_{\text{person}}, I_{\text{garment}})$ are the original inputs, $I^{\text{edit}}_{\text{garment}}$ and $I^{\text{edit}}_{\text{person}}$ are their edited counterparts, and T_{inst} denotes the natural-language instruction.

Stage 1: Structured Attribute Extraction and Instruction Generation. Given the in-shop garment I_{garment} and the corresponding on-model image I_{person}, we employ Qwen3-VL [2] to extract structured garment semantics:

$$A_g = f_{\text{MLLM}}(I_{\text{garment}}, I_{\text{person}}), \tag{2}$$

where A_g is a structured JSON with both descriptive text and explicit attributes (*e.g.*, color, pattern, material, neckline, sleeve length). Natural-language edit instructions are then synthesized via rule-based templates:

$$T_{\text{inst}} = f_{\text{temp}}(A_g), \tag{3}$$

covering two main categories, *i.e.*, *appearance edits* (color, pattern, material) and *structural edits* (adding, removing, reshaping parts). For example, a "blue cotton shirt with short sleeves" may yield "change the sleeve length to long" or "make the shirt yellow", forming $(I_{\text{garment}}, T_{\text{inst}})$ pairs.

Stage 2: Edited Garment Generation. Given the $(I_{\text{garment}}, T_{\text{inst}})$ pair, we employ the diffusion-based editor FLUX.2 Klein [27] to synthesize edited in-shop garments:

$$I^{\text{edit}}_{\text{garment}} = f_{\text{diff}}(I_{\text{garment}}, T_{\text{inst}}), \tag{4}$$

yielding approximately 300k edited samples across categories, which are subsequently refined through automated quality verification to ensure realism and instruction adherence.

Stage 3: Edited Try-On Generation. We take I_{person} and the edited garment $I^{\text{edit}}_{\text{garment}}$, and employ the state-of-the-art VTON model FitDiT [24] to generate its try-on result:

$$I^{\text{edit}}_{\text{person}} = f_{\text{VTON}}(I_{\text{person}}, I^{\text{edit}}_{\text{garment}}), \tag{5}$$

where the person is realistically rendered wearing the modified garment. The generated try-on images are subsequently validated through the same automated quality verification pipeline to ensure semantic consistency and visual fidelity.

Stage 4: Automated Quality Verification. To ensure semantic correctness and visual fidelity, we adopt a three-step verification pipeline. First, each triplet $(I, I^{\text{edit}}, T_{\text{inst}})$ is evaluated by GPT-5 [38], which outputs an edit score $s \in [0, 100]$ assessing instruction adherence, content preservation, and realism. Second, a subset of $\sim$5k annotated samples is used to fine-tune InternVL-3.5 [51], distilling GPT-5's scoring capability into a scalable multimodal evaluator:

$$f_{\text{verifier}} \leftarrow \text{Finetune}(\text{InternVL-3.5}, \{(I^{\text{edit}}, T_{\text{inst}}, s)\}), \tag{6}$$

Table 1: Comparison of fashion and general-purpose editing datasets. While existing datasets lack instruction-guided garment-person correspondences, **Dress-ED** introduces 146k verified samples enabling, for the first time, instruction-driven VTON and VTOFF.

Dataset	# Samples	# Editing Types	Automatic Generated	MLLM Filtering	Supported Tasks
General-Purpose Editing Datasets					
MagicBrush [64]	10,388	7	✗	✗	Visual Attributes Editing
RefEdit [42]	20,000	5	✓	✗	Visual Attributes Editing
UltraEdit [67]	4,108,262	9	✓	✗	Visual Attributes, Style, Background Editing
HQ-Edit [23]	450,000	7	✓	✓	Visual Attributes and Style Editing
AnyEdit [63]	2,500,000	25	✓	✓	Visual Attributes, Camera Movements, Scene Editing
ImgEdit [61]	1,200,000	11	✓	✓	Visual Attributes and Garment Editing
Fashion-Oriented Datasets					
DeepFashion2 [17]	873,234	-	-	-	Cloth Retrieval, Segmentation, Detection, Pose Estimation
Street TryOn [10]	14,453	-	-	-	Person-to-Person VTON
VITON-HD [8]	13,679	-	-	-	VTON, VTOFF
Dress Code [37]	53,792	-	-	-	VTON, VTOFF
EditGarment [62]	20,596	6	✓	✓	Instruction-Driven Garment Editing
Dress-ED (Ours)	146,460	7	✓	✓	Instruction-Driven VTON and VTOFF, Person Editing, Garment Editing, VTON, VTOFF

where I^{edit} denotes either $I^{\text{edit}}_{\text{garment}}$ or $I^{\text{edit}}_{\text{person}}$ depending on the verification target.

Finally, f_{InternVL} is applied to all edited garments and try-on results, and samples with predicted scores below a threshold t are filtered out:

$$\mathcal{S}^* = \{(I_{\text{garment}}, I_{\text{person}}, I^{\text{edit}}_{\text{garment}}, I^{\text{edit}}_{\text{person}}, T_{\text{inst}}) \mid \quad f_{\text{verifier}}(I^{\text{edit}}, T_{\text{inst}}) > t\},$$

where t is set to 80 after manual verification, retaining only samples for which both $I^{\text{edit}}_{\text{garment}}$ and $I^{\text{edit}}_{\text{person}}$ obtain a score above this threshold.

This process yields ∼146k verified high-quality samples across all garment categories, forming the final Dress-ED.

3.2 Dataset Statistics

The final Dress-ED comprises 146,460 visual quadruplets $(I_{\text{garment}}, I_{\text{person}}, I^{\text{edit}}_{\text{garment}}, I^{\text{edit}}_{\text{person}})$ paired with natural-language instructions T_{inst}, covering three representative garment categories: dresses (80,865 samples), upper-body (45,567 samples), and lower-body (20,028 samples), encompassing 49,664 distinct garment identities and 6,073 unique editing instructions. We follow the same train/test protocol as Dress Code [37], splitting

Table 2: Sample distribution by editing type.

Edit Type	Count	Proportion (%)
Add Detail	39,776	27
Change Pattern	39,559	27
Change Color	29,983	20
Modify Structure	15,670	11
Change Material	14,091	10
Remove Element	5,305	4
Fine-Grained	2,076	1
Total	146,460	100.0

the data into 132,201 training and 14,259 test samples with no overlap between partitions. All images are standardized to a resolution of 768×1024.

Editing Distribution. We define seven editing types, grouped into two macro-categories: **appearance edits**, comprising *Change Color*, *Change Pattern*, *Change Material*, and *Fine-Grained*, which modify the visual properties of the garment; and **structural edits**, comprising *Add Detail*, *Remove Element*, and *Modify Structure*, which alter its geometry or composition by adding, removing, or reshaping garment parts. Overall, the dataset exhibits substantial diversity across garment categories and edit types, establishing a comprehensive benchmark for instruction-driven VTON and VTOFF research. Table 2 provides an overview of the editing instruction statistics while a visual taxonomy of the edits is presented in the supplementary material.

3.3 Dataset Comparison

Existing fashion datasets [8, 10, 17, 29, 37] primarily target either VTON or VTOFF, but none include edited counterparts or support instruction-driven transformations. For instance, VITON-HD [8] and Dress Code [37] contain real garment–person pairs but lack text-guided edits. At the same time, general-purpose editing datasets [6,23,42,60,64,67] are built upon data triplets including the editing instruction, but lack domain-specific pairs of garment-person data that suit VTON and VTOFF. EditGarment [62] collects a dataset of garment-only editing pairs, while ImgEdit [61] contains garment data as a subsection of their dataset, lacking structured garment-person association. In contrast, our dataset introduces a novel visual quadruplet structure $(I_{\text{garment}}, I_{\text{person}}, I^{\text{edit}}_{\text{garment}}, I^{\text{edit}}_{\text{person}})$ paired with a natural-language instruction T_{inst}, where each edited garment and corresponding try-on image are coherently generated and verified. This formulation enables a range of instruction-driven fashion editing tasks, including edited VTON, edited VTOFF, person editing, and garment editing, while remaining compatible with standard VTON and VTOFF setups. A detailed comparison between Dress-ED and existing fashion and general-purpose datasets is presented in Table 1.

3.4 Benchmark Tasks and Evaluation

While Dress-ED can support a variety of instruction-driven fashion editing tasks, in this work we focus on two core benchmarks that reflect its primary objectives, *i.e.*, *instruction-driven VTON* and *instruction-driven VTOFF*. Each benchmark targets a specific aspect of instruction-based fashion editing, either the correct rendering of edited garments on people or the accurate generation of these garments in a catalog style. To evaluate both visual realism and semantic edit correctness, we introduce a dual evaluation protocol, detailed below.

Instruction-Driven Virtual Try-On. This benchmark evaluates the ability of a model to generate a realistic edited person image $I^{\text{edit}}_{\text{person}}$ conditioned on an edit instruction T_{inst} and garment context. Following standard VTON literature [8,37],

two complementary configurations are considered. In the *paired setting*, the model receives $(I_{\text{person}}, I_{\text{garment}}, T_{\text{inst}})$ and must generate $I^{\text{edit}}_{\text{person}}$ where the same garment worn by the person is modified according to T_{inst}. This configuration measures localized editing ability while preserving identity, pose, and background. In the *unpaired setting*, the model is provided with $(I_{\text{person}}, I'_{\text{garment}}, T_{\text{inst}})$, where I'_{garment} refers to a different garment image. The goal is to synthesize the person wearing the garment I'_{garment} edited as described by T_{inst}, thereby assessing practical generalization to real-world virtual shopping scenarios.

Instruction-Driven Virtual Try-Off. This benchmark focuses on garment-level editing in the catalog domain. Given a person image I_{person} and a textual instruction T_{inst}, the model must generate an edited catalog garment image $I^{\text{edit}}_{\text{garment}}$. The instruction specifies both the garment identity and the intended modification (*e.g.*, "make the skirt red"), and the target supervision is the corresponding edited in-shop image provided in Dress-ED. This task isolates the capacity to semantically manipulate garment appearance and structure independent of person-specific context.

On Using Real Images as Ground-truth Data. For rigorous quantitative evaluation, the test phase employs an inverse-editing protocol. The model is tasked with reconstructing the original, unedited person image I_{person} from its edited counterpart $I^{\text{edit}}_{\text{person}}$ using an inverse instruction T^{r}_{inst}. This guarantees that reference-based metrics are calculated strictly against real-world ground truth, accurately measuring localized editing ability while preserving identity, pose, and background without synthetic bias. We adopt this evaluation setting for all of our tasks (VTON paired, unpaired, and VTOFF).

Evaluation Metrics. We evaluate all benchmarks using two complementary metric families that jointly quantify visual fidelity and instruction adherence.

- **Visual Fidelity.** We employ standard perceptual and distributional metrics, including FID [40], KID [5], SSIM [52], LPIPS [65], and DISTS [12], computed independently for both VTON and VTOFF outputs.
- **Edit Correctness.** To evaluate semantic alignment with the editing instruction, we compute DINO-I [39] similarity between the generated image and the ground-truth image to measure content-level consistency.

Benchmark Protocol. All evaluations are conducted on the held-out test split (14,259 samples), with no overlap of garment identities across splits. For VTON, both paired and unpaired settings are reported separately. This unified protocol provides a standardized basis for evaluating instruction-driven fashion editing across VTON and VTOFF paradigms.

4 Proposed Method Towards Editing

We propose a unified multimodal diffusion architecture for instruction-driven editing, termed as **Dress-EM** (**Dress Editing Model**) and applicable to both VTON and VTOFF tasks. Our framework unifies a pretrained multimodal large

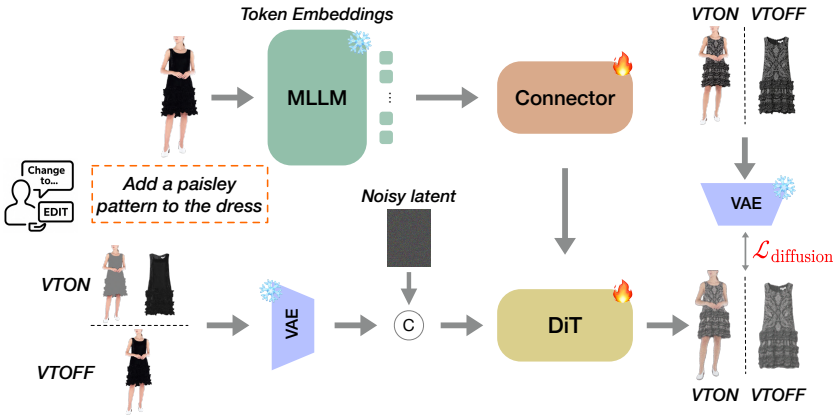

Fig. 3: Overview of the proposed Dress-EM architecture for instruction-driven fashion editing.

language model (MLLM), a lightweight connector, and a diffusion transformer (DiT) into a cohesive architecture, as illustrated in Fig. 3. The only distinction between the two tasks lies in the inputs provided to the VAE encoder: for VTOFF, the input is the original person image, while for VTON, the encoder receives both the masked person and garment features, depending on the paired or unpaired setting.

Architecture Overview. Given a visual reference I, the image of the original person, and a text instruction t, the MLLM (*i.e.*, InternVL-3.5 [51]) jointly encodes the multimodal context through a single forward pass. This produces a sequence of fused token embeddings $\boldsymbol{E}_{\text{MLLM}} = \{e_1, \ldots, e_N\}$ capturing fine-grained cross-modal relationships between the garment, the person, and the desired modification. To isolate semantically relevant tokens, we retain only those aligned with the instruction and the image, discarding system prefix and irrelevant embeddings.

Connector. The connector is a lightweight Transformer component that bridges the MLLM feature space and the DiT conditioning space. Specifically, it compresses $\boldsymbol{E}_{\text{MLLM}}$ into a multimodal latent representation $\boldsymbol{z}_c = f_{conn}(\boldsymbol{E}_{\text{MLLM}})$ and projects the mean pooled token embedding through a linear layer to produce a global guidance vector $\boldsymbol{g} \in \mathbb{R}^{2048}$ and a Token Refinement Pathway $z_c \in \mathbb{R}^{77\times4096}$.

Global Guidance Pathway (g). This pathway extracts a high-level semantic summary of the multimodal context produced by the MLLM. The connector aggregates the MLLM tokens via masked mean pooling to obtain a single context representation, which is then normalized and projected through a linear layer to produce a 2048-dimensional global guidance vector g.

Token Refinement Pathway (z_c). This pathway preserves fine-grained multimodal information by refining the full sequence of MLLM tokens. The tokens are processed by a lightweight stack of Transformer blocks that resolve cross-modal interactions and produce a refined multimodal embedding $z_c \in \mathbb{R}^{77\times4096}$.

Diffusion Transformer. Following the DiT paradigm [43], the edited image is generated in the latent space of a pretrained VAE. The DiT receives two complementary conditioning sources: *(i)* the multimodal embedding $\boldsymbol{z}_c$ and a global guidance vector $\boldsymbol{g}$ produced by the MLLM and connector, which encode the semantic action of the edit, and *(ii)* the VAE latent features $\boldsymbol{z}_{\text{VAE}}$, which capture the spatial and structural details of the visual reference. For the VTON task, the $\boldsymbol{z}_{\text{VAE}}$ is the concatenation along the width dimension of the latents of the masked person and the latents of the garment. Instead, for the VTOFF task, it is the latent of the garment. These signals allow the DiT to understand what to modify and where to apply it jointly. Formally, the denoising process is defined as

$$\hat{\boldsymbol{x}}_{t-1} = \text{DiT}(\boldsymbol{x}_t, \boldsymbol{z}_{\text{VAE}}, \boldsymbol{z}_c, \boldsymbol{g}, t), \tag{7}$$

where the DiT predicts the noise residual conditioned on both semantic and visual features. After denoising, the recovered latent $\boldsymbol{x}_0$ is passed through the VAE decoder to obtain the final edited image I^{edit}.

Optimization Objective. The model is optimized via the standard diffusion loss $\mathcal{L}_{\text{diffusion}} = \mathbb{E}_{\boldsymbol{x}_0, \boldsymbol{x}_t, t}\left[\|\boldsymbol{x}_t - \hat{\boldsymbol{x}}_t\|^2\right]$.

5 Experiments

We conduct extensive experiments on Dress-ED to validate our proposed approach and to establish benchmark results for instruction-driven fashion editing. All evaluations follow the benchmark protocols introduced in Sec. 3.4. Results are reported for instruction-driven VTON in both paired and unpaired configurations, as well as instruction-driven VTOFF. We use the real images as the ground truth to ensure a proper evaluation that is not influenced by the quality upper bounds of the ground-truth synthetic images. Therefore, given a synthetic image $I^{\text{edit}}_{\text{person}}$, we use the instruction T^r_{inst} to edit the image in order to predict I_{person}.

5.1 Implementation and Training Details

All models are trained on the proposed dataset using a resolution of 768×1024. We employ AdamW [35] as optimizer, using a cosine scheduler with a learning rate of 1×10^{-4} and a batch size of 4 for 50k steps. We use DeepSpeed [44] and train on 16 NVIDIA A100 GPUs. As diffusion backbone, we start from Stable Diffusion 3 medium [13], while we employ InternVL-3.5-8B [51] as MLLM. During training, the VAE and the MLLM are kept frozen, while the connector and the DiT are trained end-to-end. During training, we utilize both original and edited images as ground-truth targets. This mixed supervision strategy forces the model to maintain robust alignment with real-world textures while simultaneously learning complex, instruction-driven structural and appearance modifications.

5.2 Baselines and Competitors

We compare our method against both task-specific and general-purpose diffusion-based approaches relevant to VTON, VTOFF, and instruction-guided editing.

Table 3: Quantitative results on instruction-driven VTON (paired, unpaired) and VTOFF on Dress-ED. We report FID, KID, SSIM, LPIPS, DISTS, and DINO-I. ↓ indicates lower is better, ↑ indicates higher is better.

	Paired						Unpaired		
Method	SSIM ↑	LPIPS ↓	DISTS ↓	FID ↓	KID ↓	DINO-I ↑	FID ↓	KID ↓	DINO-I ↑
Edited VTON									
FLUX.2 Klein [27]	0.9291	0.0743	0.0853	4.32	1.71	0.9302	6.29	1.80	**0.6549**
Qwen-Image-Edit [54]	0.9173	0.0963	0.1135	8.51	3.42	0.8802	10.19	3.24	0.6453
Any2AnyTryon [19]	**0.9429**	0.0702	0.0795	5.34	1.98	0.9074	6.36	1.94	0.4996
CatVTON [9]	0.9314	0.0801	0.1022	4.57	1.72	0.9144	6.40	1.91	0.6476
Dress-EM (Ours)	0.9417	**0.0628**	**0.0733**	**3.79**	**1.13**	**0.9383**	**5.82**	**1.44**	0.6476
Edited VTOFF									
FLUX.2 Klein [27]	0.8694	0.2800	0.2579	17.45	7.48	0.7468	-	-	-
Qwen-Image-Edit [54]	0.8463	0.2970	0.2792	24.09	9.56	0.7192	-	-	-
Any2AnyTryon [19]	0.8757	0.2878	0.2474	19.03	6.26	0.6864	-	-	-
CatVTON [9]	**0.8800**	0.2415	0.2058	6.78	1.45	0.7918	-	-	-
Dress-EM (Ours)	**0.8800**	**0.2060**	**0.1892**	**5.06**	**0.73**	**0.8071**	-	-	-

For fairness, all task-specific models are retrained on Dress-ED using either their official source codes, when available, or faithful re-implementations following the original architectures and training protocols. For all comparisons, input resolution and evaluation splits are kept identical across methods.

VTON and VTOFF Models. We include recent state-of-the-art approaches for standard VTON and VTOFF, namely CatVTON [9] and Any2AnyTryon [19]. Since CatVTON does not natively support text input, we extend its architecture by incorporating instruction embeddings following standard conditioning practices in diffusion-based editing. This adaptation enables fair comparison under instruction-driven settings. To ensure consistency, CatVTON is retrained with Stable Diffusion 3 (medium variant), matching the pretrained backbone used in our Dress-EM model.

General-purpose Editing Models. We further evaluate large-scale multimodal diffusion models in a zero-shot setting to examine their capability for instruction-driven garment manipulation. Specifically, we include FLUX.2 Klein [27] and Qwen-Image-Edit [54], both capable of text-guided editing across generic domains. These models serve as strong foundation-level baselines for assessing semantic alignment and edit fidelity in complex fashion edits. A critical challenge is to extend these models to multi-image scenarios such as VTON. We address this scenario by concatenating image tokens at the input of the DiT [43] for both models, while preserving their spatial relationships through positional encoding.

5.3 Editing Results

We report quantitative and qualitative comparisons between Dress-EM and competing methods across all benchmark settings, using the metrics defined in Sec. 3.4.

Quantitative Results. Table 3 summarizes quantitative results across all editing tasks and settings. Overall, Dress-EM consistently outperforms all other methods,

Table 4: Per-edit-type quantitative results for instruction-driven VTON and VTOFF on Dress-ED. We report DISTS (↓) and DINO-I (↑) for the categories Change Color, Change Pattern, Change Material, Fine-Grained, Add Detail, Remove Element, and Modify Structure.

Method	Color		Pattern		Material		Fine-Gr.		Add		Remove		Struct	
	DISTS	DINO	DISTS	DINO	DISTS	DINO	DISTS	DINO	DISTS	DINO	DISTS	DINO	DISTS	DINO
Edited VTON														
FLUX.2 Klein [27]	0.081	0.939	0.100	0.908	0.085	0.939	0.081	0.936	0.075	0.941	0.084	0.935	0.078	0.943
Qwen-Image-Ed [54]	0.106	0.896	0.171	0.820	0.093	0.893	0.089	0.922	0.086	0.894	0.082	0.926	0.080	0.941
Any2AnyTryon [19]	0.070	0.937	0.099	0.865	0.072	0.923	0.076	0.917	0.074	0.906	**0.068**	0.940	0.074	0.929
CatVTON [9]	0.096	0.929	0.117	0.889	0.099	0.922	0.098	0.912	0.096	0.919	0.098	0.931	0.097	0.921
Dress-EM (Ours)	**0.066**	**0.949**	**0.087**	**0.920**	**0.070**	**0.942**	**0.072**	**0.938**	**0.067**	**0.944**	0.070	**0.947**	**0.069**	**0.946**
Edited VTOFF														
FLUX.2 Klein [27]	0.252	0.757	0.299	0.707	0.245	0.755	0.227	0.790	0.237	0.754	0.255	0.728	0.232	0.816
Qwen-Image-Ed [54]	0.267	0.757	0.379	0.650	0.238	0.757	0.233	0.761	0.227	0.725	0.260	0.729	0.221	0.766
Any2AnyTryon [19]	0.226	0.765	0.267	0.699	0.220	0.769	0.228	0.775	0.238	0.707	0.232	0.745	0.227	0.762
CatVTON [9]	0.210	0.807	0.236	0.747	0.197	0.817	0.197	0.802	0.181	0.807	0.204	0.804	0.187	0.808
Dress-EM (Ours)	**0.180**	**0.828**	**0.219**	**0.771**	**0.183**	**0.827**	**0.181**	**0.821**	**0.174**	**0.811**	**0.187**	**0.828**	**0.172**	**0.819**

demonstrating strong generalization across both paired and unpaired scenarios. In the paired edited VTON setting, Dress-EM achieves the best results across nearly all metrics, including the lowest FID, KID, LPIPS, and DISTS values. These results indicate superior image realism and faithful preservation of garment structure and identity compared to CatVTON [9] and Any2AnyTryon [19]. The strong DINO-I further validates the ability of the model to generate precise and semantically consistent edits. In the more challenging unpaired edited VTON configuration, specialized models demonstrate robust performance, maintaining a competitive edge even when handling garments unseen during the original try-on process. Dress-EM maintains high DINO-I value despite the increased complexity, confirming the robustness of its MLLM-guided conditioning and connector design.

For the edited VTOFF task, which reconstructs the edited in-shop garment from the dressed person, Dress-EM confirms the best overall performance across nearly all metrics, including the lowest FID, KID, and DISTS, and the highest DINO-I. These results demonstrate its strong capability to recover fine garment details and produce semantically faithful edits.

Per-Edit-Type Analysis. Table 4 reports a fine-grained breakdown across the seven edit categories defined in Dress-ED, evaluated using DISTS and DINO-I metrics. Dress-EM consistently achieves the lowest DISTS values (indicating higher perceptual similarity) and the highest DINO-I scores across nearly all edit types for both VTON and VTOFF. Notably, the largest improvements occur in appearance-driven edits such as color, pattern, and material, where multimodal conditioning effectively captures localized texture and tone changes. Structural modifications, including sleeve length and shape adjustments, show consistent quantitative gains, indicating that our model effectively preserves spatial coherence while performing localized structural edits.

Qualitative Results. A visual comparison is presented in Fig. 4, which showcases representative examples across both VTON (unpaired) and VTOFF settings. As it can be seen, Dress-EM produces high-quality and photorealistic results

Fig. 4: Qualitative results for edited VTON unpaired setting (first two rows) and edited VTOFF (last two rows), showing realistic and instruction-consistent edits.

that accurately follow the editing instructions while preserving person identity, pose, and garment details, further confirming the effectiveness of the proposed approach.

6 Conclusion

We introduced Dress-ED, the first large-scale dataset and benchmark for instruction-driven fashion editing that unifies VTON, VTOFF, and text-guided garment modification within a single framework. Built through a fully automated multimodal pipeline integrating MLLM-based garment understanding, diffusion-based synthesis, and LLM-guided verification, Dress-ED comprises over 146k verified, semantically consistent samples across diverse edit types. Beyond dataset construction, it establishes unified benchmarks and a multimodal diffusion baseline, enabling systematic evaluation of controllable and interpretable fashion generation. We hope this work fosters future research on multimodal garment understanding and interactive editing.

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