



CM05: Unlocking the potential of Generative AI for the pharmaceutical industry – SAS AI-enabled assistant

Mark Lambrecht

Senior Director Health & Life Sciences at SAS



Jérôme Vetillard

Principal Industry Advisor
Healthcare & Life Sciences at Microsoft





Agenda

- What is Generative Artificial Intelligence ?
 - Different flavors of AI
 - How does it work ?
 - Gen(eral) AI *Versus* Gen(erative) AI
- Healthcare & Life Sciences possible use cases
 - Clinical Ambient intelligence with Nuance
 - Drug Discovery and Generative AI
 - Copilots
- Introducing new SAS development of a AI-enabled assistant
- Food for thoughts & Questions



Introduction to Generative AI

The world is changing

Industries are transforming rapidly

The drivers for economic growth are evolving

Technology is at an inflection point

The AI technology is here

Forbes
What ChatGPT And Generative AI Mean For Your Business?

COMPUTERWORLD
Microsoft's new Teams Premium tier integrates with OpenAI's GPT-3.5

MARKETS INSIDER
Nuance and Microsoft Announce the First Fully AI-Automated Clinical Documentation Application for Healthcare

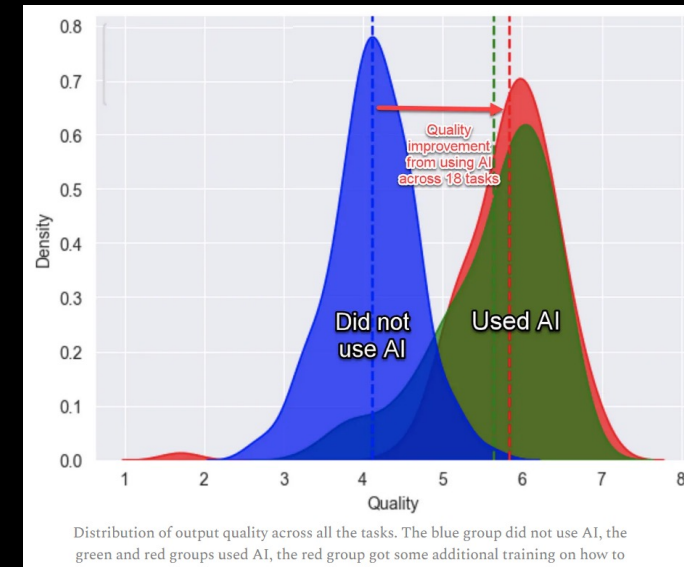
CNN BUSINESS.
Real estate agents say they can't imagine working without ChatGPT now

The Verge
ChatGPT is now available in Microsoft's Azure OpenAI service

USA TODAY
New Bing with ChatGPT brings the power of AI to Microsoft's signature search engine

HEALTHCARE DIVE
Artificial intelligence could save healthcare industry \$360B a year
Published Jan. 26, 2023

And the impact is real



Source: [Centaur & Cyborgs](#)

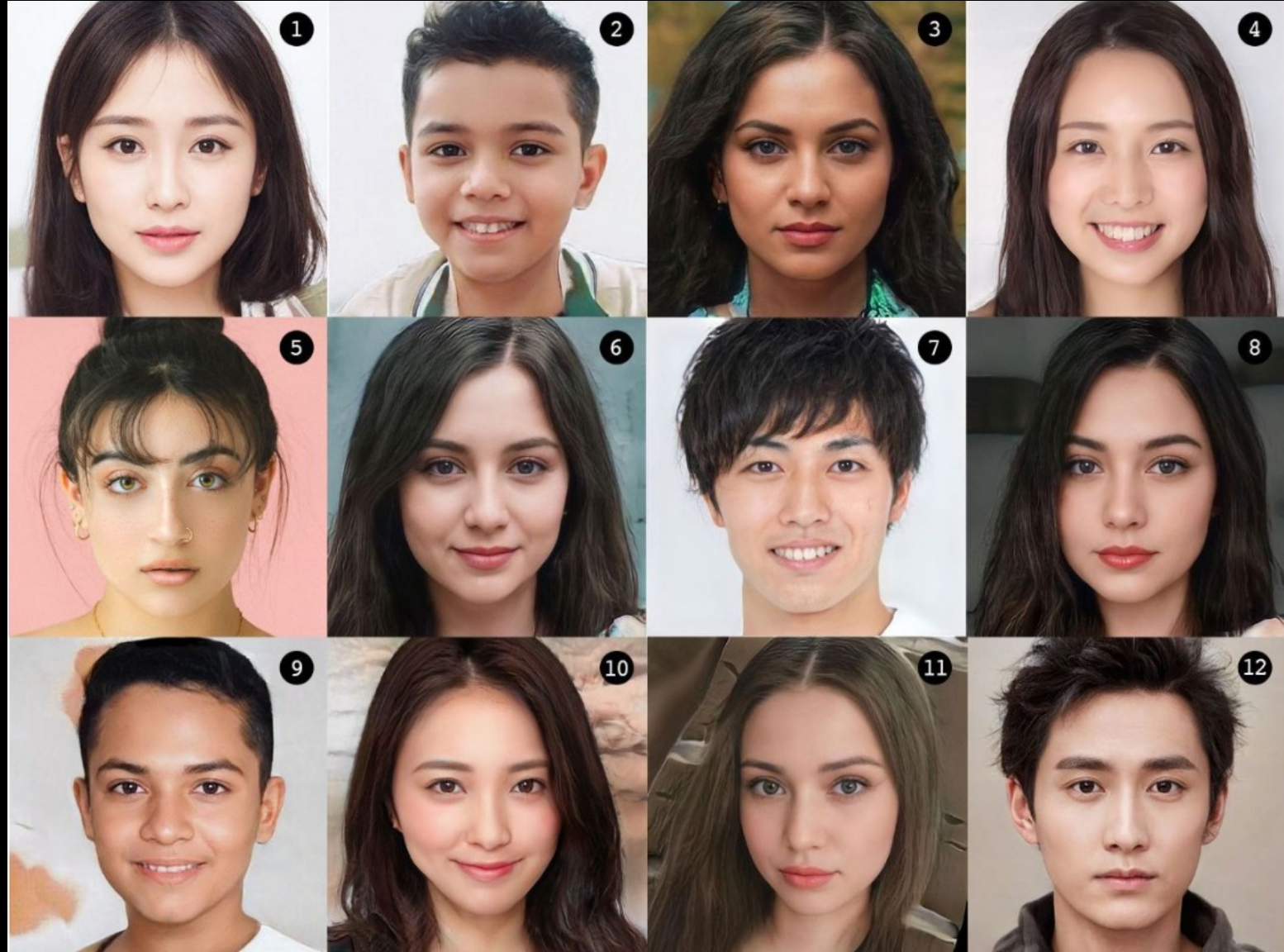
Generative Artificial Intelligence



Generative AI algorithms learn the underlying patterns in a very large training dataset and can generate new instances that are statistically similar to the original data.

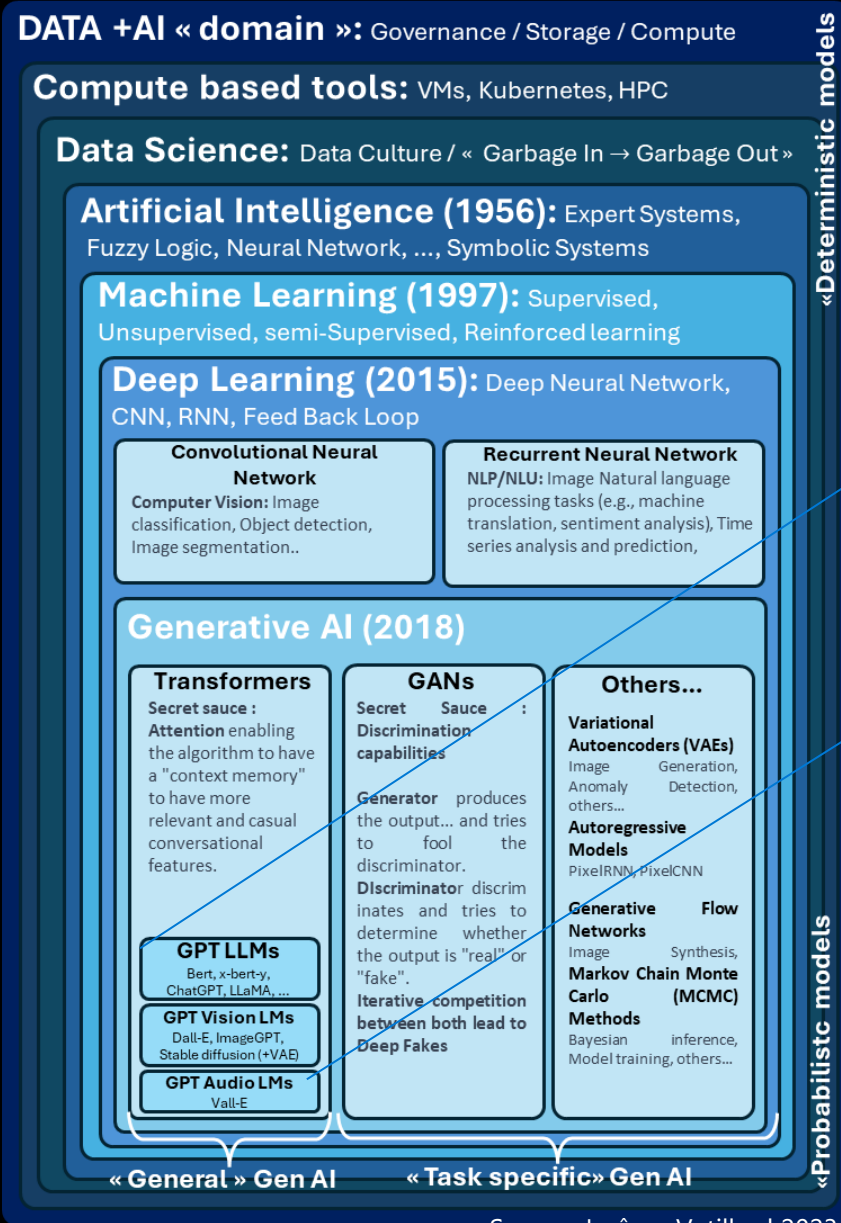
The most powerful generative AI algorithms are built on top of *foundation models* that are trained on a vast quantity of unlabeled data in a self-supervised way to identify underlying patterns for a wide range of tasks (*text, code, image, audio, video...*)

Can you beat the IA ?
Identify the only one
real face



<https://thispersondoesnotexist.com>

Data + AI: Historical review of the landscape



Within Azure, OpenAI services are "just" a powerful family of AI-services offered



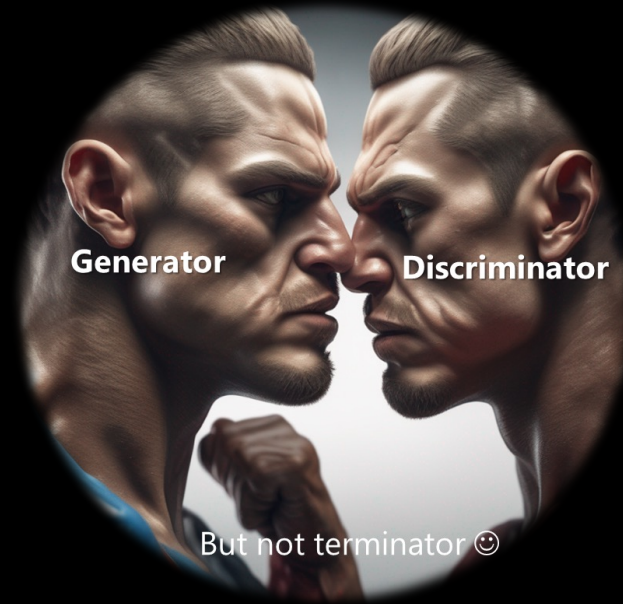
Transformers & GANs: two pillars of Generative AI

TRANSFORMERS



Natural Language Understanding
Natural Language Processing

GENERATIVE ADVERSARIAL NETWORKS (GANs)



Media Generation (Image/Video/Audio)
Discrimination

Generative AI: Potential Legal risks / Trustworthy AI



Generative AI (GAI) has taken the world stage, and it is here to stay. Advances in GAI are accelerating faster than either governing bodies or society have had time to reasonably address. In some categories of GAI, business value, risk, and ethics have yet to be reconciled. Resolving these three factors is critical.

SAS has long been a pioneer in, and a champion of, AI innovation. At SAS, we know that advances in technology don't exist in a vacuum and can have far-reaching effects and implications.

SAS considers trustworthy and ethical AI to set the strategy and guardrails for all AI, and generative AI, innovation. Core to SAS DNA is to place human-centricity, customers, and “doing the right thing” first.

SAS is committed to innovating responsibly while inspiring and empowering our customers, partners, and communities to do the same.



Microsoft Responsible AI Principles:

1. Fairness

All AI systems should treat all people fairly.

2. Reliability & Safety

AI systems should perform reliably and safely.

3. Privacy & Security

AI systems should be secure and respect privacy.

4. Inclusiveness

AI systems should empower everyone and engage people.

5. Transparency

AI systems should be understandable.

6. Accountability

People should be accountable for AI systems.

Microsoft Pledges Legal Protection for Customers Against AI-Generated Copyright Claims

Microsoft will provide legal protection to its commercial customers against third-party copyright infringement lawsuits, provided they adhere to Microsoft's established guardrails and content filters.

Don't mistake Gen(eral) AI & Gen(erative) AI



Just Another Rather Very Intelligent System (JARVIS)

JARVIS is a General AI, multimodal, multipotent, augmented with robotic peripherals... It can handle a complex conversation and derive action plans for execution (it can calculate and build IronMan armors... and many other things).

JARVIS is an ecosystem of specialized systems with powerful orchestration

Speech to text + LLM+ Text to Speech would only be the NLP/NLU layer of JARVIS, the polite voice able to interact with Tony Stark (Conversational Language Understanding – CLU-)

BUT.... IT IS POSSIBLE TO FUNCTIONALLY ENRICH LLM, STEPS TO MULTIMODAL AI

EXTEND LLM CAPABILITIES VIA PLUGINS

It is possible to extend the NLU/NLP core capabilities of LLM with « plugins ». Plugins provide new capabilities to LLM, leveraging their NLU/NLP capabilities to feed other specialized API (web search, PDF reader, computer vision...) which provide API-processed data back to the LLM.

PREPOPULATE THE PROMPT TO HAVE FOCUSED EMBEDDINGS

You can « ground » the LLM with a « preprompt » telling the LLM how it should behave (role, context, expectations, tone guidance...).
Providing pairs of Question/Answer is also another way to « ground » the LLM and limit hallucinations.

RAG & FINE TUNING

Retrieval Augmented Generation combines a retriever to the LLM. It will search documents, internet to enrich and generate more contextual embeddings along with the prompt itself.

Fine-Tuning is a re-training of the LLM with a more specialized dataset, but also modifying other parameters of the the training. Fine-Training can be used to augment the context memory (the attention) of the LLM.

SAS and Large Language Models

Three distinct
approaches

1

**SAS Viya to
help build
GAI apps.**

SAS Viya provides capabilities that you can use in your LLM app stack and toolchain.

2

**AI Assistants
to help you
use SAS
tools.**

SAS will incorporate GAI to improve productivity with SAS Viya, further democratize analytics, and reduce cost of ownership.

3

**AI Assistants
to help with
industry-
focused tasks.**

SAS will deliver industry- and domain-specific solutions that help organizations increase process efficiencies, optimize yield, or mitigate risks.



Use Cases in Life Sciences

Generative AI : most prominent HLS scenarios we are observing across the value chain

Healthcare Automation: Companies like **Anthropic**, *DataGen*, *data.world* are automating clinical data extraction, integration and analytics using generative models to standardize records and power evidence-based decisions. [Microsoft Nuance ambient clinical intelligence](#) is revolutionizing the way HCP and patient interpersonal relationship to produce gold clinical data.

Healthcare Chatbots: AI assistants use generative capabilities for question-answering, decision support and virtual consultation in areas like imaging, genomics, clinical trials. During the COVID crisis, health organizations have created 1,230 COVID-19 self-assessment bots based on the Microsoft Healthcare bot service, reaching 18 million individuals and serving more than 160 million messages. Now these bots are powered by Generative AI ([Azure Healthbot](#)).

Drug Discovery: AI startups like *Exscientia* and *DeepMind* are employing GANs and VAEs to generate novel molecular structures with desired properties, speeding up drug R&D. DeepMind's AlphaFold has also transformed protein structure prediction. [Azure Quantum Elements](#) speeds up certain chemistry simulations by 500,000 times, which is like compressing a year into one minute.

Genomic Analysis: Companies like *Anthropic*, *Insitro* and *TwoXAR* are leveraging generative language models to surface novel gene relationships and functional impacts from integrated omics datasets, advancing precision medicine. [Microsoft Genomics](#) can support your most demanding sequencing needs in a secured and scalable environment.

Clinical Trial Optimization: AI startups are developing techniques to synthesize prototype patient data (data augmentation & digital twins) and dynamically adapt trials based on outcomes, making them more efficient and personalized. [SAS Viya platform](#) concentrates all latest digital innovations needed to speed-up your clinical analytics.

Generative AI : ambient intelligence to optimize the HCP/patient interaction (NUANCE)



- Ambient intelligence provided by NUANCE DAX capture with its NLP/NLU capabilities all the meaningful information during the anamnesis.
- It can complete the patient history in the EMR
- Empowering the HCP to be really focused on her/his interpersonal relationship with the patient.



Captures a multi-party conversation ambiently

Clinicians engage in natural conversation with patients and other family members while the mobile app securely captures the conversation at the point of care, allowing clinicians to connect with patients rather than screens.



Creates clinical documentation automatically

Converts encounter conversations into comprehensive specialty-specific clinical documentation summaries, and delivers the summary into the application and the Dragon Medical One desktop in seconds for clinician review and editing.



Produces high-quality documentation

Uses the latest AI technologies and is trained on over 10M encounters to produce accurate documentation efficiently and consistently.



Works seamlessly with electronic health records

Used in conjunction with Dragon Medical One which integrates with over 200 EHRs, streamlining implementation.

Generative AI : Generation is not the big issue when dealing with Drug Discovery

Combinatory
Chemistry

High
Throughput
Screening

Hit to lead

PK/PD

Safety
Assessment
Pre clinical
studies

Formulation

Clinical Trial
Phase 1

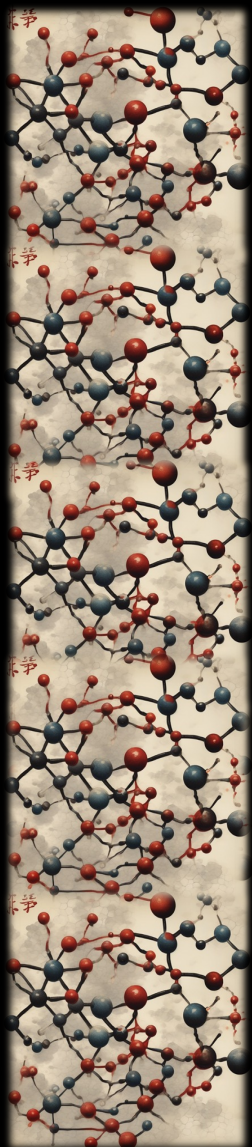
Clinical Trial
Phase 2

Clinical Trial
Phase 3

New Drug
Application

Review &
Approval
Process

Post
Marketing
Pharmaco
vigilance



Phase	Combinatory Chemistry	High-Throughput Screening	Hit-to-lead
Process description	Combinatory chemistry to generate large libraries of molecules (drug candidates)	High-Throughput Screening (HTS) to rapidly test a large number of compounds against specific biological targets	Hit-to-lead optimization involves modifying the initial hit molecule to improve its potency, selectivity, and pharmacokinetic properties.
Currently...	Guided chemical synthesis patterns (Lengthy & complex) either in solid or liquid phase High Throughput Parallel Synthesis (Robotic Diversity Oriented synthesis)	Automated (robotics) micro-well assays against compounds librairies (Very complex, lengthy, expensive) Assays against compound-librairies in microwells with robotics and computerized analytics.	Computerized assays, In-vivo, In-Vitro assays, PK/ADME...(Very complex, very lengthy, very expensive) Structure-Activity Relationship (SAR) Analysis, ADME (absorption, distribution, metabolism, and excretion), ...
With Gen AI...	De Novo Molecule Design : variational autoencoders (VAEs), or generative adversarial networks (GANs) to generate structurally diverse and synthetically feasible molecules .	The GAN discriminator's ability to evaluate the quality of generated compounds can aid in selecting and prioritizing compounds for experimental validation. Discrimination, not generation is the key point	Generative AI models can propose new scaffolds or analogs based on the initial hit compound(s). Generative AI models could learn from large datasets of compounds with known absorption, distribution, metabolism, excretion (ADME), and toxicity properties



Introducing a
SAS Copilot-like
functionality

Generative AI : SAS and Microsoft partner to add top notched Gen AI to the SAS Platform



YUXI FLUORITE | LEVEL 6

Could Github Copilot help us write SAS code?

Posted 07-31-2023 03:38 AM (551 views)

Has anyone done some research on github copilot? This AI plug-in (in VS Code) can support many mainstream programming languages, so can it also help us write SAS code? 😊

There is a demand for this kind of features !!!

But poor outcome « out of the box » !

FreelanceReinh JADE | LEVEL 19

Re: Extracting year and month from date9. date

Posted 01-31-2023 09:04 AM (284 views) | In reply to PaigeMiller

@PaigeMiller wrote:

I add that ChatGPT did not give you the best answer, it did not give you the easiest answer, and it gave you an answer that will cause difficulties if you need to perform arithmetic or logical operations on these month values (because these month values are now character, and you can't do math easily on character strings).

Not to mention the incorrect FORMAT statement it suggested, attempting to apply a numeric format to a character variable:

```
11 data example;
12   input date :date9.;
13   year_month = put(date, yymn6.);
14   format date date9.;
15   format year_month yymn6.;
16   cards;
```

48
ERROR 48-59: The format \$YYMMN was not found or could not be loaded.

NOTE: The SAS System stopped processing this step because of errors.
WARNING: The data set WORK.EXAMPLE may be incomplete. When this step was stopped there were 0 observations and 2 variables.
NOTE: DATA statement used (Total process time):
real time 0.03 seconds
cpu time 0.01 seconds

Hopefully, SAS & Microsoft partner together to bring SAS "Copilot" to you !!!



HOME ARTICLES ▾ INSIGHTS ▾ INFORMATION

SAS partners with Microsoft to bring generative AI to the enterprise

SAS AI-enabled assistant for Code Gen

Type a comment to generate code

Copilot.sas U ●

tmp-sas-copilot > testcode > Copilot.sas > ...

1  Brainstorm | [Generate code](#) | Explain | Add comments | Prompt

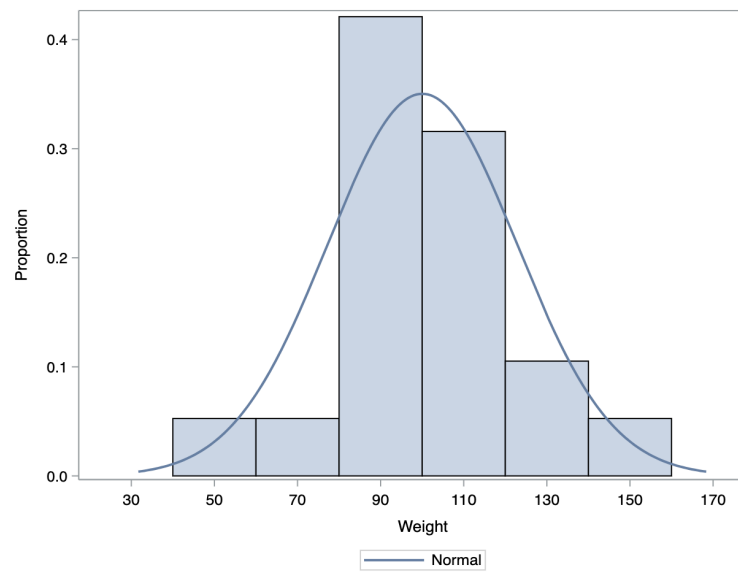
2 `/* create a normal distribution dataset */`

3

```
26
27 /* create a normal distribution dataset */
28
29
30 /* Import the necessary library for drawing graphs */
31 proc sgplot data=sashelp.class;
32 /* Define the distribution plot and specify the normal distribution
33 histogram weight / showbins scale=proportion;
34 density weight / type=normal;
35 run;
36
37 /* Import the necessary libraries for statistical analysis */
38 proc univariate data=sashelp.class noprint;
39 histogram weight / normal;
40 run;
41
42
43
44
45
46
47
48
```

Result

PROC UNIVARIATE



Proportion

Weight

Normal

The UNIVARIATE Procedure

SAS AI-enabled assistant for Code Gen

Explain the code

The image displays the SAS Viya Copilot interface, which includes a conversation window on the left and a code editor on the right.

SAS Viya Copilot: CONVERSATION WINDOW

You

Explain the code

SAS Viva Copilot

This SAS code is used to perform a statistical analysis and to create a graphical representation of the data.

In the first part of the code:

The **proc sgplot** procedure is used to create statistical graphics. The **data=sashelp.class;** statement is used to select the data set which is 'class' from the 'sashelp' library.

histogram weight / showbins scale=proportion; is instructing SAS to create a histogram of the 'weight' variable in the data set. The 'showbins' option allows for the visualization of the data bins in the histogram. The scale is set to 'proportion', meaning the y-axis reflects the proportion of total observations rather than the count itself.

density weight / type=normal; This line is instructing SAS to plot a normal density curve on the histogram for the 'weight' variable.

The **run;** statement is used to execute the procedure.

In the second part of the code:

The **proc univariate** procedure is used to provide summary statistics and to perform other univariate analysis. Again, the 'class' data set from the 'sashelp' library is specified by **data=sashelp.class;**. The 'noprint' option suppresses the usual printed output from the PROC UNIVARIATE procedure.

histogram weight/normal; This line is instructing SAS to produce a histogram of the 'weight' variable supplemented with a normal curve fit, which illustrates how data is distributed around the mean.

The second **run;** statement is used to execute the instructions outlined in the 'proc univariate' section of the code.

Code Editor:

```
tmp-sas-copilot > testcode > Copilot.sas > ...  
25  
26  
27 /* create a normal distribution dataset and draw */  
28  
29  
30  
31 /* Import the necessary library for drawing graphs */  
32 proc sgplot data=sashelp.class;  
33 /* Define the distribution plot and specify the normal distribution */  
34 histogram weight / showbins scale=proportion;  
35 density weight / type=normal;  
36 run;  
37  
38 /* Import the necessary libraries for statistical analysis */  
39 proc univariate data=sashelp.class noprint;  
40 histogram weight /  
41  
42  
43  
44  
45  
46  
47  
48
```

Context Menu:

- Run Selected or All SAS Code (F3)
- Run All SAS Code (F8)
- Run Region
- Change All Occurrences
- Refactor...
- Share
- Cut (⌘ X)
- Copy (⌘ C)
- Paste (⌘ V)
- SAS Copilot: Add comments
- SAS Copilot: Format
- SAS Copilot: Translate to SAS
- SAS Copilot: Explain**
- SAS Copilot: Refine
- SAS Copilot: Find problems
- SAS Copilot: Analyze log
- SAS Copilot: See examples
- SAS Copilot: Brainstorm
- Command Palette... (⌘ P)

Bottom Bar:

PROBLEMS OUTPUT DEBUG

7 02:52:00 PM

88 ods html5;
NOTE: Writing HTML5 Body file sashtml5.html
89 /* Set the seed for the random number generator */

SAS Log Friday,

SAS AI-enabled assistant for Code Gen

See Proc examples

The image displays the SAS Viya Copilot interface, which includes a conversation window on the left and a code editor on the right.

SAS Viya Copilot Conversation Window:

- SAS Viya Copilot**
- The **sgplot** keyword in SAS development refers to the 'Statistical Graphics' procedure that produces single-cell graphs. This keyword is fundamental in creating various types of plots such as scatter plots, line plots, step plots, and histograms, etc. SG Procedures are designed to create high-quality graphs rapidly and easily.
- An important feature about SG Procedures, including **sgplot**, is that they automatically handle many of the details that you had to specify in traditional SAS/GRAPH procedures. Moreover, it also accommodates group variables for enabling graph classification and makes it convenient for the user to customize graphs.
- Here are a few examples
- Basic SGPLOT

```
proc sgplot data=sashelp.class;
  histogram height / binwidth=5;
run;
```

In the above code, a histogram of the height variable from sashelp.class data is created. The **binwidth=5** option creates bins or categories with a width of 5 units.

Using scatter plot:

```
proc sgplot data=sashelp.iris;
  scatter x=SepallLength y=PetalLength;
run;
```

This code generates a scatter plot of SepallLength against PetalLength for the iris dataset.

Using SGPLOT with a group:

```
proc sgplot data=sashelp.iris;
  scatter x=SepallLength y=PetalLength / group=species;
run;
```

Buttons for copying, pasting, and adding code are visible next to the code blocks.

Code Editor:

 - File: tmp-sas-copilot > testcode > Copilot.sas > PROC SGPLOT
 - Line 30: **proc sgplot data=sashelp.class;**
 - Line 31: **/* create a normal distribution dataset */**
 - Line 32: **/* Import the necessary library for drawing graphs */**
 - Line 33: **/* Define the Selected or All SAS Code**
 - Line 34: **/* Define the Selected or All SAS Code**
 - Line 35: **run;**
 - Line 36: **/* Import the necessary library for drawing graphs */**
 - Line 37: **/* Define the Selected or All SAS Code**
 - Line 38: **proc univariate data=sashelp.class;**
 - Line 39: **histogram height / binwidth=5;**
 - Line 40: **run;**
 - Line 41: **/* Import the necessary library for drawing graphs */**
 - Line 42: **/* Define the Selected or All SAS Code**
 - Line 43: **/* Define the Selected or All SAS Code**
 - Line 44: **run;**
 - Line 45: **/* Import the necessary library for drawing graphs */**
 - Line 46: **/* Define the Selected or All SAS Code**
 - Line 47: **/* Define the Selected or All SAS Code**
 - Line 48: **run;**

Context Menu:

 - Change All Occurrences
 - Refactor...
 - Share
 - Cut
 - Copy
 - Paste
 - SAS Copilot: Add comments
 - SAS Copilot: Format
 - SAS Copilot: Translate to SAS
 - SAS Copilot: Explain
 - SAS Copilot: Refine
 - SAS Copilot: Find problems
 - SAS Copilot: Analyze log
 - SAS Copilot: See examples**
 - SAS Copilot: Brainstorm
 - Command Palette...

PROBLEMS OUTPUT:

```
real time 0.05 seconds
cpu time 0.05 seconds
```

SAS Log:

```
104 proc univariate data=work.sample2 noprint;
105 var Height;
ERROR: Variable HEIGHT not found.
106 output out=work.normal (drop=_TYPE_ _FREQ_) normal(blksize=10000 seed=52633) ranuni;
```

SAS AI-enabled assistant for Code Gen

Refine the code

SAS VIYA COPILOT: CONVERSATION WINDOW

SAS Viya Copilot

Here is an optimized version of your SAS code:

```
/* Import the library only once */
libname mylib 'C:\sasdemo';

/* Perform statistical analysis before plotting */
proc univariate data=mylib.class noprint;
  var weight;
  histogram / normal;
run;

/* Then plot the graph with necessary labels and titles for
proc sgplot data=mylib.class;
  title "Histogram with Normal Curve";
  histogram weight / showbins scale=proportion fill;
  density weight / type=normal lineattrs=(color=red);
  xaxis label = 'Weight';
  yaxis label = 'Frequency';
run;
```

Here are the reasons why I made these changes:

Importing Libraries: Instead of importing libraries multiple times, it's a good practice to do it once at the beginning for efficiency.

Order of Operations: Perform the statistical analysis first before plotting for better workflow order.

Variables: In the `proc univariate`, I specified the `var` statement to clearly indicate which variable is being analyzed.

Labels and Titles: I added titles and labels on x-axis and y-axis to make the graph more understandable.

Plotting: I added fill option to the histogram for better visual aspect and change the line color for the density plot to red for contrast.

Note: Please replace 'C:\sasdemo' with your library current location.

Clear conversation

Ask a question...

Copilot.sas U

tmp-sas-copilot > testcode > Copilot.sas > ...

```
25
26
27 /* create a normal distribution dataset and draw */
28
29
30 /* Import the necessary library for drawing graphs */
31 proc sgplot data=sasHELP.class;
32 /* Define the distribution plot and specify the normal distribution */
33 histogram weight / showbins scale=proportion;
34 density weight / type=normal;
35 run;
36
37 /* Import the necessary libraries for statistical analysis */
38 proc univariate data=sasHELP.class noprint;
39 var weight;
40 histogram weight / normal;
41 run;
42
43
44
45
46
47
48
```

Run Selected or All SAS Code F3

Run All SAS Code F8

Run Region

Change All Occurrences

Refactor...

Share

Cut

Copy

Paste

SAS Copilot: Add comments

SAS Copilot: Format

SAS Copilot: Translate to SAS

SAS Copilot: Explain

SAS Copilot: Refine

SAS Copilot: Find problems

SAS Copilot: Analyze log

SAS Copilot: See examples

SAS Copilot: Brainstorm

Command Palette...

PROBLEMS OUTPUT DEBUG CONSOLE

7 02:52:00 PM

88 ods html5;

NOTE: Writing HTML5 Body file: sashtml3.htm

89 /* Set the seed for the random number generator */

SAS Log

Friday,

SAS AI-enabled assistant for Code Gen

Find problems

SAS VIYA COPILOT: CONVERSATION WINDOW

You

Find problems in the code

SAS Viya Copilot

Overall, the SAS code provided is largely correct with a minor issue. The Proc **sgplt** isn't the valid procedure in SAS, the correct procedure is **sgplot**.

Corrected SAS code would be as follows:

```
/* Correct plot procedure */
proc sgplot data=sashelp.class;
  /* Define the distribution plot and specify the normal dis
    histogram weight / showbins scale=proportion;
    density weight / type=normal;
run;

/* Import the necessary libraries for statistical analysis */
proc univariate data=sashelp.class noprint;
  histogram weight / normal;
run;
```

The **sgplot** procedure is a powerful graphics procedure, capable of creating single-cell graphs of various kinds. It has numerous options for creating plots for visualizing your data. The **sgplot** procedure is easier to use and provides more options than the traditional plot procedure, making it a preferred choice for data visualization.

Clear conversation

Ask a question...

Copilot.sas U

tmp-sas-copilot > testcode > Copilot.sas > ...

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

66

67

68

69

70

71

72

73

74

75

76

77

78

79

80

81

82

83

84

85

86

87

88

89

90

91

92

93

94

95

96

97

98

99

100

101

102

103

104

105

106

107

108

109

110

111

112

113

114

115

116

117

118

119

120

121

122

123

124

125

126

127

128

129

130

131

132

133

134

135

136

137

138

139

140

141

142

143

144

145

146

147

148

149

150

151

152

153

154

155

156

157

158

159

160

161

162

163

164

165

166

167

168

169

170

171

172

173

174

175

176

177

178

179

180

181

182

183

184

185

186

187

188

189

190

191

192

193

194

195

196

197

198

199

200

201

202

203

204

205

206

207

208

209

210

211

212

213

214

215

216

217

218

219

220

221

222

223

224

225

226

227

228

229

230

231

232

233

234

235

236

237

238

239

240

241

242

243

244

245

246

247

248

249

250

251

252

253

254

255

256

257

258

259

260

261

262

263

264

265

266

267

268

269

270

271

272

273

274

275

276

277

278

279

280

281

282

283

284

285

286

287

288

289

290

291

292

293

294

295

296

297

298

299

300

301

302

303

304

305

306

307

308

309

310

311

312

313

314

315

316

317

318

319

320

321

322

323

324

325

326

327

328

329

330

331

332

333

334

335

336

337

338

339

340

341

342

343

344

345

346

347

348

349

350

351

352

353

354

355

356

357

358

359

360

361

362

363

364

365

366

367

368

369

370

371

372

373

374

375

376

377

378

379

380

381

382

383

384

385

386

387

388

389

390

391

392

393

394

395

396

397

398

399

400

401

402

403

404

405

406

407

408

409

410

411

412

413

414

415

416

417

418

419

420

421

422

423

424

425

426

427

428

429

430

431

432

433

434

435

436

437

438

439

440

441

442

443

444

445

446

447

448

449

450

451

452

453

454

455

456

457

458

459

460

461

462

463

464

465

466

467

468

469

470

471

472

473

474

475

476

477

478

479

480

481

482

483

484

485

486

487

488

489

490

491

492

493

494

495

496

497

498

499

500

501

502

503

504

505

506

507

508

509

510

511

512

513

514

515

516

517

518

519

520

521

522

523

524

525

526

527

528

529

530

531

532

533

534

535

536

537

538

539

540

541

542

543

544

545

546

547

548

549

550

551

552

553

554

555

556

557

558

559

560

561

562

563

564

565

566

567

568

569

570

571

572

573

574

575

576

577

578

579

580

581

582

583

584

585

586

587

588

589

590

591

592

593

594

595

596

597

598

599

600

601

602

603

604

605

606

607

608

609

610

611

612

613

614

615

616

617

618

619

620

621

622

623

624

625

626

627

628

629

630

631

632

633

634

635

636

637

638

639

640

641

642

643

644

645

646

647

648

649

650

651

652

653

654

655

656

657

658

659

660

661

662

663

664

665

666

667

668

669

670

671

672

673

674

675

676

677

678

679

680

681

682

683

684

685

686

687

688

689

690

691

692

693

694

695

696

697

698

699

700

701

702

703

704

705

706

707

708

709

710

711

712

713

714

715

716

717

718

719

720

721

722

723

724

725

726

727

728

729

730

731

732

733

734

735

736

737

738

739

740

741

742

743

744

745

746

747

748

749

750

751

752

753

754

755

756

757

758

759

760

761

762

763

764

765

766

767

768

769

770

771

772

773

774

775

776

777

778

779

780

781

782

783

784

785

786

787

788

789

790

791

792

793

794

795

796

797

798

799

800

801

802

803

804

805

806

807

808

809

810

811

812

813

814

815

816

817

818

819

820

821

822

823

824

825

826

827

828

829

830

831

832

833

834

835

836

837

838

839

840

841

842

843

844

845

846

847

848

849

850

851

852

853

854

855

856

857

858

859

860

861

862

863

864

865

866

867

868

869

870

871

872

873

874

875

876

877

878

879

880

881

882

883

884

885

886

887

888

889

890

891

892

893

894

895

896

897

898

899

900

901

902

903

904

905

906

907

908

909

910

911

912

913

914

915

916

917

918

919

920

921

922

923

924

925

926

927

928

929

930

931

932

933

934

935

936

937

938

939

940

941

942

943

944

945

946

947

948

949

950

951

952

953

954

955

956

957

958

959

960

961

962

963

964

965

966

967

968

969

970

971

972

973

974

975

976

977

978

979

980

981

982

983

984

985

986

987

988

989

990

991

992

993

994

995

996

997

998

999

1000

Brainstorm | Generate code | Explain | Add comments | Prompt

/* Import the necessary library for drawing graphs */

proc sgplt data=sashelp.class

/* Define the distribution plot and specify the normal distribution */

histogram weight / showbins scale=proportion;

density weight / type=normal;

run;

/* Import the necessary libra

proc univariate data=sashelp.

histogram weight / normal;

run;

Run Selected or All SAS Code F3

Run All SAS Code F8

Run Region

Change All Occurrences

Refactor... ^⇧R

Share >

Cut ⌘X

Copy ⌘C

Paste ⌘V

SAS Copilot: Add comments

SAS Copilot: Format

SAS Copilot: Translate to SAS

SAS Copilot: Explain

SAS Copilot: Refine

SAS Copilot: Find problems

SAS Copilot: Analyze log

SAS Copilot: See examples

SAS Copilot: Brainstorm

Command Palette... ⇧⌘P

PROBLEMS OUTPUT DEBUG CONSOLE

7

02:52:00 PM

The SAS System

88 ods html5;

NOTE: Writing HTML5 Body file: sashtml3.htm

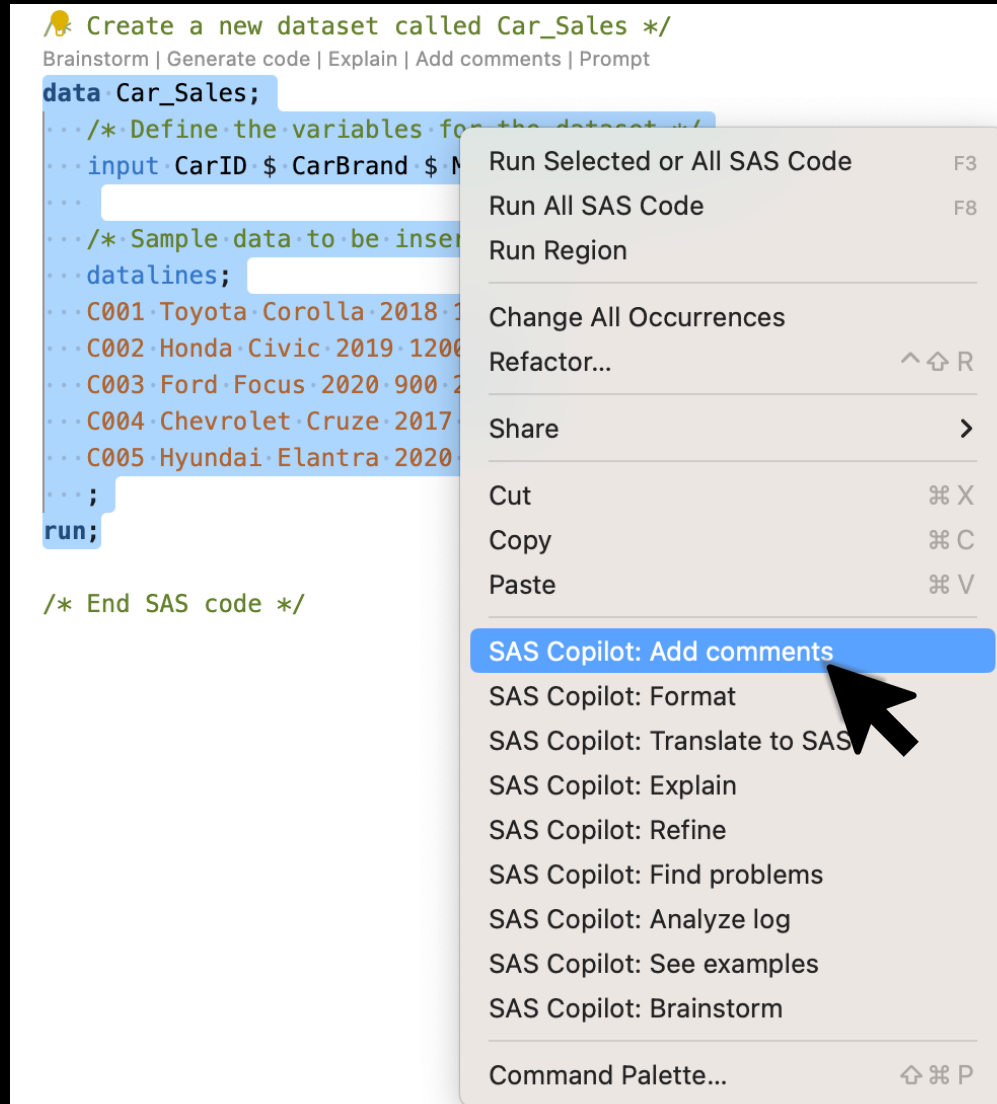
89 /* Set the seed for the random number generator */

SAS Log

Friday, 4

SAS Copilot-like functionality for Code Gen

Add comments to code



SAS AI-enabled assistant for Code Gen



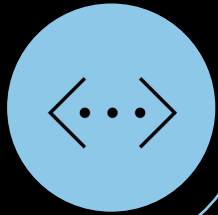
User Interface

- **NOW** via Visual Source Code Extension
- **NEXT** Any code editor integrated throughout Viya



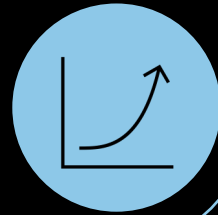
Users

- Novice → Advanced SAS Programmers



Use

- **NOW** Generate SAS code for a variety of data and analytical procedures
- **NEXT** Enable 9 → Viya migration
- **NEXT** Customize to industries



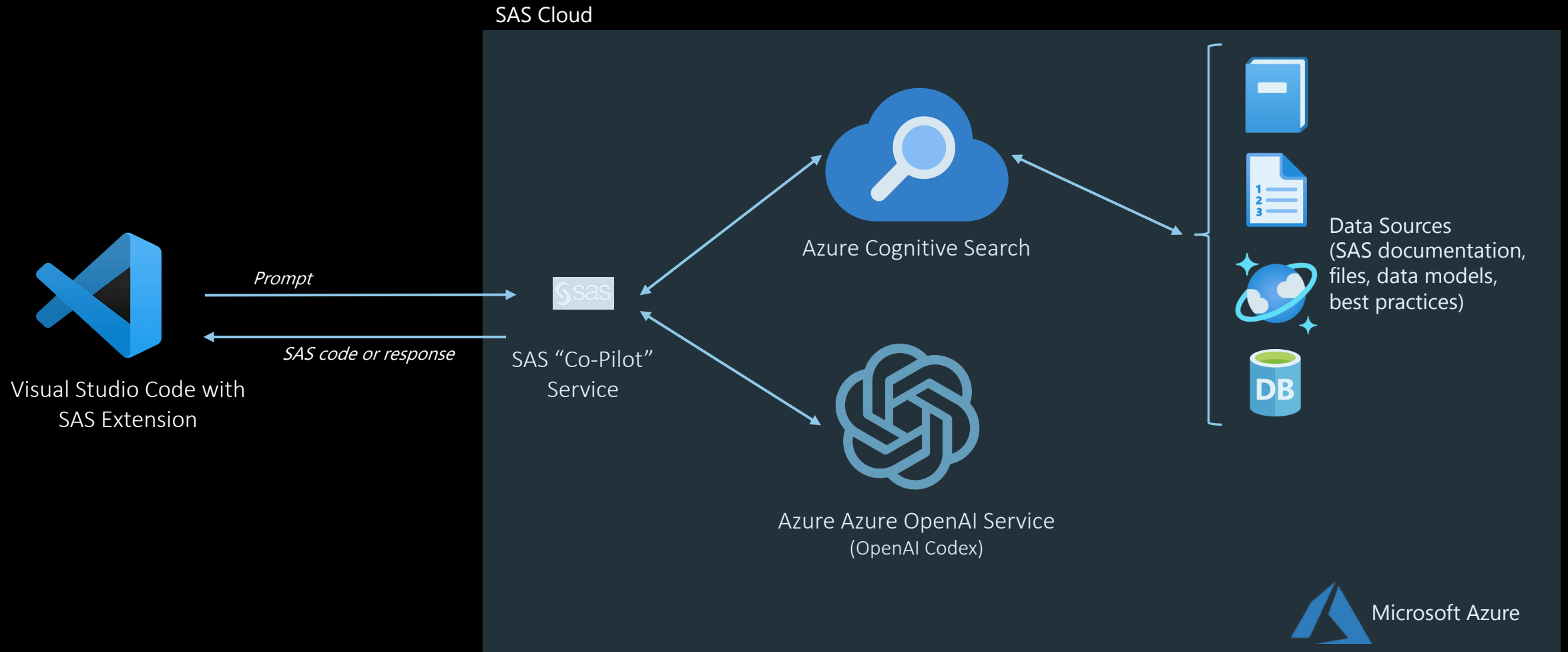
Value

- Increased productivity and speed to market
- Decreased developer time spent on reviewing SAS documentation & syntax
- Increased discoverability of SAS capabilities
- Available via subscription service

SAS AI-enabled assistant leveraging Azure & RAG

Available via connection to SAS Cloud on Azure.

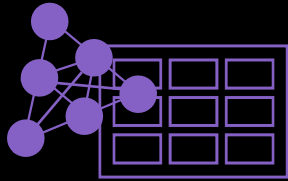
Benefits from the most secured Cloud environment and data privacy highest standards



SAS and Generative AI

SAS includes these three AI/ML categories as part of its approach to generative AI:

Synthetic Data Generation



Digital Twin



Large Language Models

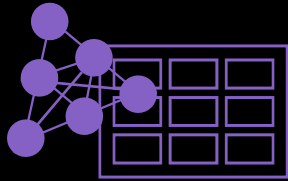


SAS and Generative AI

SAS includes these three AI/ML categories as part of its approach to generative AI:

In Clinical Trials...

Synthetic Data Generation



Useful when not enough data, such as with rare diseases

Digital Twin



For virtual patients to simulate “what if” scenarios

Large Language Models



Automate manual tasks, like building an FDA-regulated eCRF from a protocol

Combining SAS and Microsoft's Azure OpenAI Service

Strategic: How do we transform clinical trial analysis and submission?

AI-Enhanced SAS Life Sciences Analytics Framework

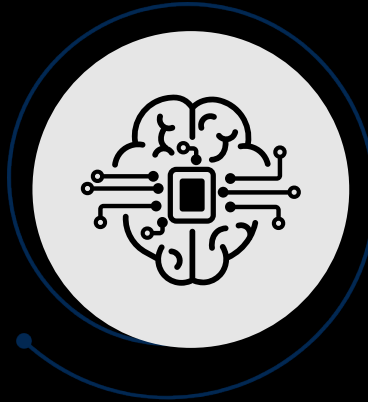
SAS strives to combine:

- OpenAI's GPT capabilities to process natural language queries and generate responses
- SAS's expertise in statistical computing environments for clinical research
- Dynamic embeddings built by SAS to tailor the results for clinical studies
- All on top of the enterprise-grade characteristics of Azure.



What are possible outcomes?

- Use GPT-3+ to turn a protocol into an auto-generated electronic case report form
- Analyze vast amounts of patient data to identify high-potential candidates during cohort and patient selection
- Review enrollment simulations for patient recruitment
- Use NLP to extract patient-reported outcomes.



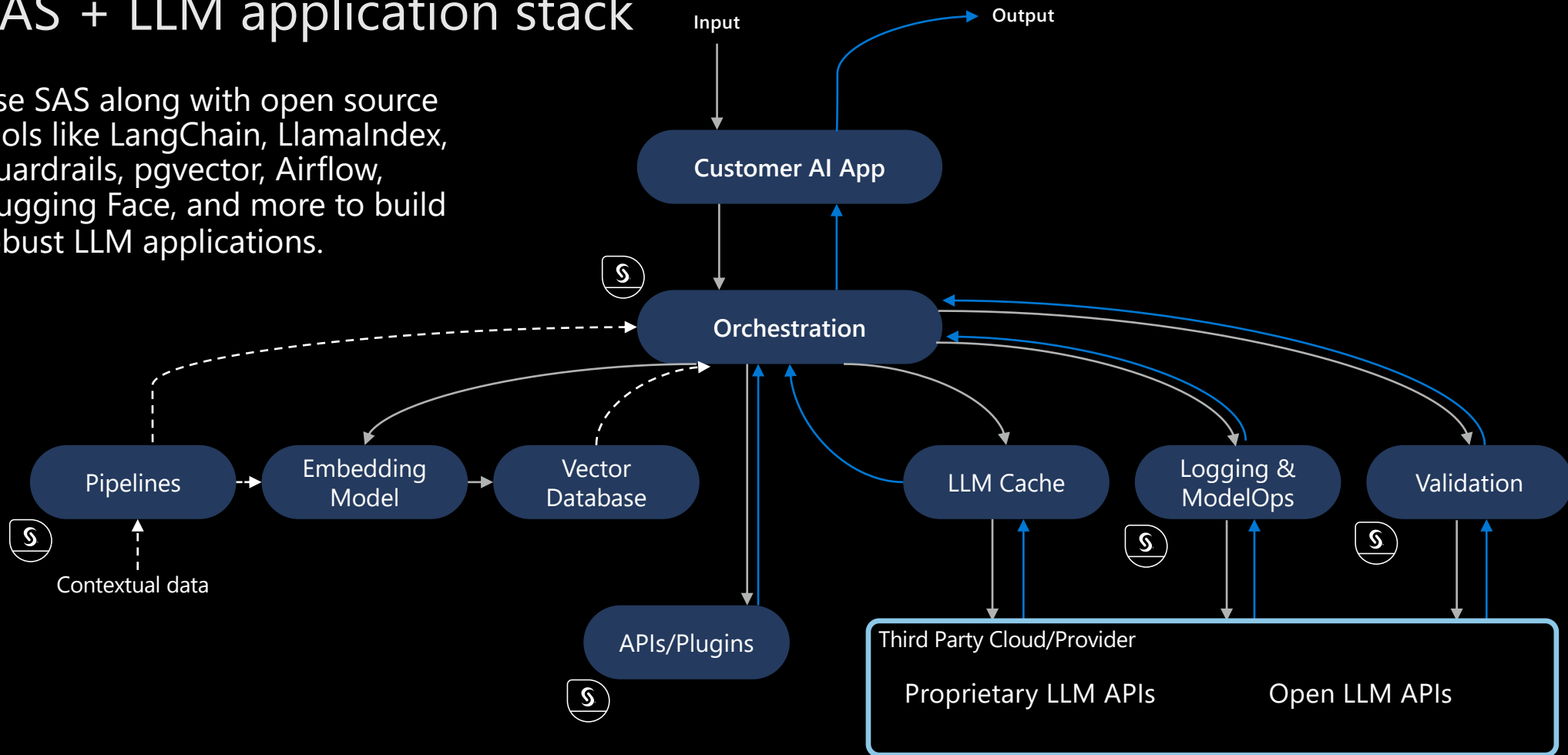
AI Assistants to help with industry-focused tasks

SAS will deliver industry- and domain-specific solutions that help organizations increase process efficiencies, optimize yield, or mitigate risks.

SAS Viya to help build gen AI apps

SAS + LLM application stack

Use SAS along with open source tools like LangChain, LlamaIndex, Guardrails, pgvector, Airflow, Hugging Face, and more to build robust LLM applications.





Food for
thought...

Explainability of AI and LLMs : the lost fight ?

Principle #3: Transparency

How AI works must be **easily explained** by those who create it and by those who use it.

Problem: To promote unbiased and inclusive AI, we must therefore be able to give the means to anyone (without being an expert) to be able to easily check its functioning and detect possible bias or manipulation.

How can you trace the dynamic behavior of 175+ billions of parameters when it comes to decision making explainability ?

The chaos theory and emergence laws make the emergence of "eloquence" possible...

...but they also make explainability obsolete

[\(41\) Artificial intelligence: Is it as "stupid" as a Galton board? | LinkedIn](#)

Responsible AI and Sustainability ?

On the evening of Wednesday, December 2, Timnit Gebru, the co-lead of Google's ethical AI team, announced [via Twitter](#) that the company had forced her out.

“On the Dangers of **Stochastic Parrots: Can Language Models Be Too Big?**” lays out the risks of large language models—AIs trained on staggering amounts of text data. These have grown increasingly popular—and increasingly large—in the last three years. **They are now extraordinarily good, under the right conditions, at producing what looks like convincing, meaningful new text**—and sometimes at estimating meaning from language. But, says the introduction to the paper, “we ask whether enough thought has been put into the potential risks associated with developing them and strategies to mitigate these risks.”

ARTIFICIAL INTELLIGENCE

Training a single AI model can emit as much carbon as five cars in their lifetimes

Deep learning has a terrible carbon footprint.



Common carbon footprint benchmarks

in lbs of CO2 equivalent

Roundtrip flight b/w NY and SF (1 passenger)	1,984
Human life (avg. 1 year)	11,023
American life (avg. 1 year)	36,156
US car including fuel (avg. 1 lifetime)	126,000
Transformer (213M parameters) w/ neural architecture search	626,155

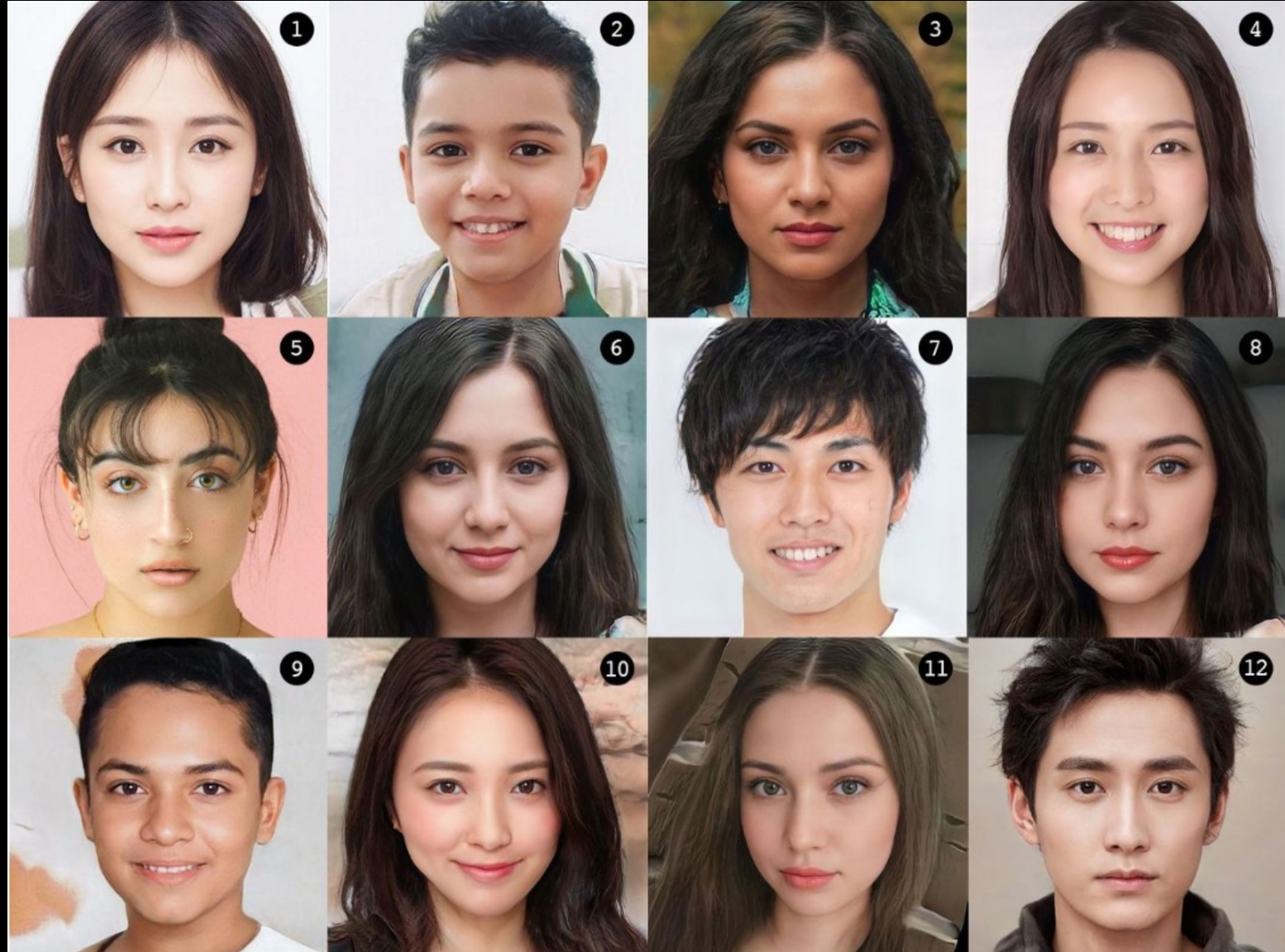
Chart: MIT Technology Review • Source: Strubell et al. • Created with Datawrapper

Multi modality : The next frontier



- Generative AI has advanced in various domains, including image/video generation, voice synthesis, text synthesis, and even molecule design.
- The next frontier of generative AI is multi-modality, where models can generate and combine multiple types of data simultaneously.
- Multi-modality refers to the ability of AI models to generate outputs that incorporate diverse modalities seamlessly.
- Multi-modal generative AI combines different modalities to create cohesive and expressive outputs.
- It enables the synthesis of complex and integrated outputs, going beyond individual components.
- Applications of multi-modal generative AI include multimedia content generation, interactive storytelling, virtual environments, and personalized recommendations.
- Challenges include designing effective architectures, utilizing multi-modal datasets, and developing specialized training techniques.
- Some other philosophical, social, legal challenges will arise : intellectual property, deep fakes and mass control. Overcoming these challenges opens up exciting opportunities for AI in understanding and generating multi-modal data.

Did you make
the right guess ?



<https://thispersondoesnotexist.com>



Questions

